INTERIOR DESIGN CRITERIA FOR SUCCESSFUL HOSPITAL PATIENT ROOMS

A THESIS
SUBMITTED TO THE DEPARTMENT OF
INTERIOR ARCHITECTURE AND ENVIRONMENTAL DESIGN
AND THE INSTITUTE OF FINE ARTS
OF BİLKENT UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF FINE ARTS

By
Seda Bilir
February, 1997

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I certify that I have read this thesis and in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Fine Arts.

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ABSTRACT

INTERIOR DESIGN CRITERIA FOR SUCCESSFUL HOSPITAL PATIENT ROOMS

Seda Bilir

M.F.A. in

Interior Architecture and Environmental Design

Supervisor: Asst. Prof. Dr. Halime Demirkan

February, 1997

In this study, the design requirements of hospital acute-care patient rooms, which support the recovery and well-being of the patients, are examined. Patients' psycho-spatial needs which may be complementary to the healing effects of the medical treatment and the necessary design requirements related to the room activities are mentioned. With respect to the patients' comfort, hospital stress factors, social interaction, visual and acoustical privacy concerns, considerations related to the patients' need of personalization of space, sense of control, and the other sensory issues are discussed. Furthermore, medical care delivery requirements and the activities which affect the design are explored. In this sense, requirements related to the size and layout of the patient rooms, furniture, accessibility for physically impaired persons, color selection and natural and artificial lighting, heating, ventilation, air conditioning systems, and materials are discussed. Finally, general design criteria for providing successful patient care in hospital rooms are pointed out.

Key words: Therapeutic design, Psycho-spatial needs of patients, Space planning, Interior design criteria.

ÖZET

BAŞARILI HASTANE ODALARI İÇİN İÇ MİMARLIK TASARIM ÖLÇÜTLERİ

Seda Bilir

İç Mimarlık ve Çevre Tasarımı Bölümü

Yüksek Lisans

Tez Yöneticisi : Doç. Dr. Halime Demirkan

Bu çalışmada, hastane akut-bakım odalarında, hastanın iyileşmesini destekleyici tasarım gereksinimleri araştırılmıştır. Hastaların, tıbbi tedaviyi destekleyen psiko-mekansal ihtiyaçları ve hasta odası tıbbi etkinlikleri için önemli olan tasarım gereksinimleri belirtilmiştir. Hastaların fiziksel konforuna bağlı olarak, hastane ortamının yarattığı gerginlik nedenleri, sosyalleşme ve hastaların görsel ve işitsel mahremiyet kaygıları, mekanı kişiselleştirme, ve kontrol etmeye yönelik ihtiyaçları ve diğer duyumsal gereklilikler tartışılmıştır. Bununla birlikte, tasarımı etkileyen tıbbi tedavi gereklilikleri ve etkinlikleri araştırılmıştır. Bu bağlamda, oda tasarımı, mobilya, fiziksel özürlüler tarafından kullanılabilirlik, renk seçimi, doğal ve yapay ışıklandırma, havalandırma, ve malzeme konuları tartışılmıştır. Sonuç olarak, hastane odalarında daha iyi hasta bakımı için gerekli tasarım ölçütleri belirlenmiştir.

Anahtar sözcükler: Tedaviyi destekleyici tasarım, Alan planlaması, Hastaların psiko-alansal gereksinimleri, İç mimarlık tasarım ölçütleri

ACKNOWLEDGEMENTS

First, I would like to thank Asst. Prof. Dr. Halime Demirkan for her valuable support, endless patience and help, without which this thesis would not have been completed. I gratefully appreciate Ms. Demirkan for her constant guidance whose faith in this study was pivotal to its growth.

I also would like to offer my gratitude to my parents, Necmel and Suavi Bilir; to my sisters, Eda Bilir and Ayça Yüksel; and also to my brother, İbrahim Bilir for providing me multitudinous large and small act of support and help during my studies.

Finally, I would especially like to thank my friends, Altuğ Candır, Ebru Özseçen, Zeynep Atalı, Aylin Damgacı, Nihan Fikri and Aslıhan Gürbüz for their unfailing help and patience, without whose support, I would not have been able to finish this thesis.

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1. INTRODUCTION

1.1. The Problem

A century ago, the search for health care projects whose design both pleased the eye and served the health care givers and the patients was an effort that ended in frustration. With increasing competition between the hospitals, the administrators had recognized that the well-designed hospital interiors made excellent marketing sense (Tetlow, 1994).

The fact is every decade brought a new direction and a new buzzword for health care design (Malkin, 1992). In 1960's, architecture has become increasingly integrated into the marketing strategies of the health care facilities and hospitals. In addition to the functional requirements of care delivery, esthetic goals have gained importance. Humanizing the hospital environment which means getting away from the clinical, and institutional look has been favored by many health care administrators in the following ten years. The 1970's has introduced hospitality to health care design. In 1980's, the value of design, physical qualities of a health care environment and its importance for a successful patient care have been introduced by a patient-centered care model called Planetree unit. It provides therapeutic care environments for patients in addition to the functional and technical requirements of health care delivery (Bosker, 1987; Malkin, 1991). Due to

the example of Planetree and growing consciousness about mind/body/environment connections, professionals recognized that the design of a patient room can help patients to improve health and it is one of the most important requirements of a successful patient care. Today, all hospitals and other health care facilities accept the benefits of creating a therapeutic patient rooms in order to provide better health care. As creating a therapeutic patient room environment has become the most important goal of entire health care design industry, there is a need to think how to create such room environments which help patients in their recovery and well-being.

1. 2. Aim of the Study

There are various aspects that should be taken into account in creating a therapeutic acute-patient room design that complements and enhances healing effects of medical technology. The literature review part of this study aims to explore environmental conditions, concepts and design-related needs of patients that help to develop a therapeutic design. In this manner, psycho-spatial considerations, environmental expectations and needs of main user group who are generally patients and care givers will be explored. All those efforts are done in order to point out the requirements of a successful or health promotive patient room design and also, to prepare a design checklist to be used as a guideline for the future hospital projects.

1.3. Structure of the Thesis

In addition to introduction and conclusion chapters, this thesis includes four main chapters which explore and discuss the problem in various aspects and considerations.

The second chapter gives a brief information on human and the built-environment interrelationship. In this context, the power of the built-environment which affects the human beings, either negatively or positively, is explored. In the second section, considering the impacts of physical conditions of an environment on the human beings, the question of how the power of the built-environment can be used constructively and the therapeutically in health care is examined. As an integral component of patient care environment and recovery and well-being, therapeutic potential of a physical setting and its importance for a successful patient care is discussed. In the last section, the term therapeutic environment is described and various related factors and their relationships with each other are explored. This section also serves as an introductory to the third and the fourth chapters.

In order to figure out psychological aspects of a patient room design and the related patients needs, stress and illness relationship is investigated in the first section of the third chapter. The environmental stressors, hospital stress factors and their negative effects are presented in the following section. With respect to these stress factors, related psychological patient needs and design aspects which are important in creating a therapeutic patient room environment are explored in the latter section of this chapter.

The fourth chapter covers the functional and physical aspects of a therapeutic patient room design. In this sense, various interior design elements of a patient room are discussed and explanatory information is given in order to use them in best ways for fulfillment of health care delivery needs. In the first section, considerations related to an optimally sized patient room are discussed. Patients' and care givers' needs related to the room design, elements, and equipment are also examined. Accessibility

concerns for a patient bedroom and a bathroom are given in the third section. The fourth section is based on an information required for the best use of color in a patient room design. Although no specific rules are given, it provides a valuable knowledge for the best color selection. Various considerations and technical data on light, its use in a hospital patient room and lighting design recommendations are discussed in the fifth section. Heating, ventilation and air conditioning systems and the related concerns are given as another technical requirement of a hospital patient room in the sixth section. The latter part of the forth chapter discusses different materials which are suitable for a patient room.

Within this framework, the fifth chapter is based on design guidelines for creating therapeutic acute-care patient rooms which support healing psychologically as well as physically.

2. INTERRELATIONSHIP BETWEEN HUMAN AND THE BUILT-ENVIRONMENT

For many decades, the human and the built-environment relationship has been discussed within the context of various different aspects and ways. Researchers and scholars from various disciplines, such as sociology, psychology, anthropology, architecture, interior architecture, environmental psychology, human factors, landscape architecture and urban and regional planning have conducted number of studies to explore whether environmental conditions of a physical setting affects the human beings or not. Needless to say that a large number of those studies were based on the theories proving that there is a strong interrelationship between the human and the built-environment whereas the others claimed that there is not such a relationship between the two (Festiger et al., 1950; Whyte, 1954; Kuper, 1953; Gans, 1961; Adams, 1968; Hologan and Seagert, 1973; Le Corbusier, 1973 as documented in Lang, 1987; Zimring, Carpman and Michelson, 1987).

Although reviewing the literature and presenting what have been done till today is not the concern of this chapter, brief summary of the inherent power of the built-environment on human beings is necessarily required. Because it will help to figure out whether or not this power can be used to create positive and assisting room environments for a better patient care and also, serve as a groundwork as well as an introduction for the following chapters.

Therefore, the concern of the last section will be about the therapeutic potential of the environment and the essential physical conditions that generate therapeutic environment.

2.1. Impacts of the Built-Environment on Human Beings

A large number of studies have showed that the human beings are responsive to their environments and certainly affected by them (Weiss and Baum, 1987; Birren, 1988; Day, 1990; Malkin, 1991). Since people experience space, nature, landscape and the built-environment in physical, emotional, and cognitive ways, conditions of the physical settings and the information provided by them arouse physiological, psychological, emotional responses. In addition, the physical health and stress levels of the individuals are affected which are more critical in the vulnerable ones.

With respect to the human experiences with the environment there have been many studies, such as Schafer's (1977, 1985 as documented in Seamon, 1987) descriptive work on the sonic environment, and Pocock's (1987 as presented in Seamon 1987) and Cohen's (1980 as given in Weiss and Baum, 1987) works on the relationship between noise and stress that provided the bases for the environmental sensitivity of the human beings. Heschong's (1979 as mentioned in Seamon, 1987) work investigated the symbols, and the architectural elements associated with the feeling of cold and warm and how the thermal environment can provide such experiences as delight, affection and sacredness. Rowles (1983 as documented Seamon, 1987) explored the sense of place and community for older people living in a small village. Hill (1985 as given in Seamon, 1987), also, emphasized the importance of bodily sensitivity to the environmental conditions. Winett (1987) implied that behavior is under the control of the environment, and

Barker (1950 as stated in Winett, 1987) named it as the environmental determinism. Fisher and his colleagues (1984 as stated in Winett, 1987) have also developed a descriptive framework to address the effects of environmental conditions on the human beings and behavior. A study conducted by Ulrich (1984 as documented in Weiss and Baum, 1987), showed that patients who were exposed to the naturalistic view had shorter hospitalization, and also, stated fewer negative comments to the hospital staff and required less potent analgesics compared to patients with the wall view. Ulrich argued that the natural view could have caused positively changes on the patients (or changes in their care) that results in more rapid recovery.

Based on these researchers, it is obvious that the built-environment can be used as a powerful tool in order to create health promotive, therapeutic environments that help patients in their recovery and healing processes.

2.2. Use of Therapeutic Potential of the Built-environment in Health Care

According to Day (1990), due to the fact that the physical environment has strong effects on human beings, human consciousness, on place and ultimately on the world, it can have negative effects as well as equally strong positive effects, if it is seriously considered and consciously handled. William (1992) suggests that the patient behaviors and their recovery can be directly affected by the design of a physical setting. Patterns of interaction with the others can be changed by design features as shown by various studies in the psychiatric units and long term care facilities (Holahan and Seagert 1973; Sommer, 1969 as indicated in Williams, 1988). Feeling of privacy and security, as well as orientation and satisfaction with the setting, control over

the space and comfort can be affected and also, achieved by design. Using the design features to accomplish therapeutic patient care environments and their outcomes should be considered very seriously, and accepted as an alternative way to support the effective processes of care. Such processes also, depend on knowledgeable staff working in a supportive social and organizational environment (Williams, 1992).

Norman Cousins, a professor at the University of California at Los Angeles Medical School, also believes the inherent potential of an environment and insists that the design of a patient room can help patients to improve health and recovery. He suggests holistic approach (body/mind and environment connections) including a positive attitude and relaxed familiar surroundings can aid healing process. As he explains this, " Environment has a large part to do with getting the best out of health care", he claims " It is not a theory, it is the fact" (Knight, 1987:48). There are many health care designers who admire the idea that architecture and design can have therapeutic effects and speed recovery (Freeman, 1987; Nesmith, 1987). Davies and Menaged, who are the designers of Renfrew Center, (an eating disorders facility in Philadelphia), say "Design is an important tool for the recovery and well-being of patients in health care facilities" (Knight, 1987:48). Henry Betts, the medical director of Rehabilitation Institute of Chicago, claims that well-designed interiors can motivate patients to recover and he also, adds that " We all know what a nice landscape or garden can do to relieve stress and make us fell better. Color, art, and lighting and other environmentally related design features are important in motivating people to feel good. They promote a comfortable, healing quality that cares for the soul." (as quoted in Russell, 1994:66).

Recently, various researches have shown that the environmental organization and the design of a hospital can affect patients' recovery and well-being of its many inhabitants (Andeane, 1991). Obviously, space planning has greatly an impact on function and also, on ease of circulation, but more subtle are psychological messages encoded in the environment. According to Malkin (1991), this sort of explanations given by people from different disciplines emerge the power that is inherent in the physical settings. "The physical setting of health care environments can have therapeutic potential, architects and designers have to think about how to develop it" says Malkin and adds that "Besides, many architects believe that people should not have to adapt themselves to the buildings that have been designed for their comfort and support clinical programs. General belief is that hospital design has to be adapted to the needs of patients" (Malkin, 1991:34). Izumi (1968 as documented in Lang, 1987) also, suggests that in hospital buildings the equipment should be designed according to the conditions of people.

Today, in creating therapeutic care environments, more and more attention is being paid to the psychological needs of the patients. Visual considerations as color and space that once been ignored, are becoming a part of the design program for the hospitals and nursing homes. Designers and medical staff are both paying attention to the way the human mind affects the healing of the human body and the health care facilities are being designed to heal the mind as well as the body (Winslow, 1990). Design of a physical setting and its relationship to the healing process are being popularized by both the administrators and health care designers. According to Robert Horsburgh, a medical doctor at Emory University School of Medicine at Atlanta, medical care can not be separated from the buildings in which it is delivered. Because the qualities of physical setting in such

buildings affect the outcome of medical care and the architectural and interior design are thus, an important part of the healing process. In addition, understanding and achieving of spatial qualities that provide a successful patient care is important to health care providers for two reasons. First, they are aware of the effects of environmental conditions on healing in order to manage better patient care. Secondly, informed health care givers can be advocates for good design in the planning and construction for health care facilities in future projects (Horsburgh, 1995).

According to Malkin (Calmenson, 1996) some 25 years ago, health care design was a new field and the idea that environment could positively or negatively influence the body's ability to heal was nothing than a revolutionary. Today, the goal of many health care administrators, designers and doctors who are so accustomed to white, clinical environments is to design for healing. In this sense, color, comfort, architectural cues that provide easy way findings, and nature --plants, flowers, sunlight and water-- that relieves anxiety are being considered as components of patient-care environments. In addition, inherent potential of a physical setting to complement and enhance the healing effects of drugs and medical technology is widely being acknowledged by people from different disciplines. In sum, today's physicians and health care administrators, health givers, architects, and designers commonly accept the benefit of a therapeutic, supportive environment and its immune enhancing effects in patient recovery and well-being (Calmenson, 1996).

As regarding the key benefit of creating therapeutic environment in health care settings, the question of what is meant by the term therapeutic patient room environment has to be answered.

2.3. Creating a Therapeutic Patient Room Design

The term 'therapeutic' is described by Webster's Collegiate Dictionary as:

> **therapeutic** \-'pyu-tik\ *adj* [Gk *thrapeutikos*, fr. *therapeuein* to attend, treat, fr. *theraps* attendant] (1946) **1:** of or relating to the treatment of disease or disorders by remedial agents or methods < a ~ rather than a diagnostic specialty > **2:** providing or assisting in a cure : **CURATIVE, MEDICINAL** < ~ diets> < a ~ investigation of the government waste > **---ther.a.peu.ti.ca.ly** \-ti-k (-)lé \ *adv* . (1223)

According to Canter and Canter (1979) therapeutic environment is a place in which therapy occurs to a major therapeutic agent. Williams (1992) described the meaning of the term as the physical design of setting and its social environment are both oriented toward enhancing therapeutic goals and activities. In other words, therapeutic environment is a compensatory and an assisting environment. If it is to be achieved in a patient room, the elements of the physical setting should be arranged in order to support the technical and functional requirements of health care delivery and also, encourage the activities essential for achieving desired patient outcomes without imposing additional stresses on the patient. In other words, the design should go beyond those functional issues and focus on concepts of dignity and self-worth (Calkins, 1992). This comment also, emphasizes the importance of satisfying patients' psychological needs related to room design. The fact is there are many researchers, health care administrators and designers commonly sharing the same opinions and point of views. According to Malkin (1991) in a therapeutic patient room environment, interior design issues must adequately facilitate all functional and technical requirements related to care delivery as well as psychologically support the patients' treatment, healing and recovery process. Basic components may include air quality, thermal comfort, noise control, privacy, light,

communication, color, texture, accommodation for families, views of nature, visual serenity for those who are very ill, and visual stimulation for those who are recuperating. As Carpman and her colleagues (1986 documented in Andeane, 1991: 41) mention the interior design issues must be provided and considered within the context of design-related psychological needs of patients and psycho-environmental stress factors.

As a conclusion, if a therapeutic, health promotive patient room environment is to be achieved, the physical design of setting should support medical treatment, recovery and healing processes functionally, technically as well as psychologically. Since those psychological concerns are considered the most important part of the recovery and successful patient care, the whole design of physical setting or interior design elements and issues must be arranged according to these psychological concerns. These psychological factors and arrangement of interior design elements of a patient room design are the concerns of next two chapters in which all subjects will be explored and discussed in detail.

3. PSYCHO-SPATIAL ASPECTS OF A HOSPITAL PATIENT ROOM DESIGN

For many decades health care design has been concentrated on the functional and technical requirements of health care delivery. The central concern of patient room design has long been based on complicated functional requirements having to do with health care operations on behalf of the patients. In other words, psychological needs of patients have never been considered in patient room design created by such approaches. There have been, on the other hand, many researchers who have supported the idea of designing health care environments which are psychologically supportive and also encouraging healing and recovery processes of patients. According to these researchers and many other health care designers the room design must answer the psychological needs of patients in addition to functional, technical requirements of health care delivery. By psychologically supportive design, researchers refer to creating rooms where patients' stress is eliminated or at least reduced by the design of physical setting. In this sense, stress and stress reducing is certainly the most important psychological consideration that must be carefully taken into account in designing patient rooms (Carpman and Grant, 1993; Deasy and Lasswell, 1985; Malkin, 1991).

The fact is whether patient's hospital stay is short or long, there are certain considerations of room design related to psychological needs of patients in order to make the stay more comfortable and support the patient's sense of personal competence and ability to cope with problems caused by illness. Because the patient's psychological condition and related physical appearance are critical issues for determination and recovery processes, the fulfillment of psychological needs related to stress are necessary. It is an obvious and complementary requirement of successful patient care indeed. This requirement, of course affects the whole design and outlook of patient rooms. Design-related psychological needs of patients must be seriously considered in patient room design, because anything a designer can do to reinforce a patient's sense of self-worth, competence and dignity is a contribution to patient's recovery process (Malkin, 1991, Deasy and Lasswell, 1985).

In order to create psychologically supportive patient rooms, the design of a physical setting should be free from both environmental and psychological stress factors. In other words, the room must be designed for physical comfort, privacy, control and ease of communication among patients and with the health care staff. Besides, patients should have access to the views of nature (from the bed), and control over lighting levels, room temperature and privacy. They should not have to get disturbed by noise of carts or conversation in corridors. They should be surrounded by a moderately stimulating palette of colors and texture and other finishing materials. The overall goal should be to reduce a patient's stress level so that healing can take place (Malkin, 1991; Deasy and Lasswell, 1985).

In this chapter, design-related psychological needs of patients will be discussed within the context of a hospital room stress factors. In order to

figure out these stress conditions and eliminate their effects for creating therapeutic environments in patient rooms the powerful relationship among stress, illness and related needs will be explored in detail. This must be a central concern of psychologically supportive patient room design where patients' psychological needs are satisfied. Therefore, in the first sections of this chapter hospital stress factors and their impacts on patients will be discussed.

3.1. Stress and Illness

According Weiss and Baum (1987), "Stress is a process that includes translation of environmental demands or treats into psycho-physiological responses" (229). Generally, stress is caused by events called stressors which may be originated by the environmental conditions of a physical setting or the psychological factors related to the environmental conditions. There has been a sizable body of research which indicate the impacts of environmental conditions and the processing of the information provided by them affect behavioral, psychological, and physiological responses of the human beings and cause stress on them (Cohen, 1978; Frankenhaeuser, 1975; Zubek, 1969 as documented in Weiss and Baum, 1987).

Carpman and Grant (1993) says "Stress can become a major obstacle to healing. Patients feeling stress from environments that are not designed to be supportive can experience increased blood pressure, muscle tension, and suppressive effects on their immune system"(9). Stress is an important factor for prevention and treatment of illnesses (Genest and Genest, 1987) In addition, Weiss and Baum (1987) suggest "Stress may have direct psychological and physiological effects on patients which influence their health, immune system and healing processes" (299). In the patient rooms, if

the design of a physical setting is incongruous with the fulfillment of patient's physical and psychological needs, it causes stress, frustration, passiveness, hopelessness or depression on the patients which negatively effect and impede well-being and recovery (Andeane, 1991). A large number of studies show that stress at any age is known to alter the release of hormones, elevate blood pressure, constrict blood vessels, cause muscle fatigue and debilitate the immune system. It is also known as a major factor that causes heart attacks or other cardiac distresses, ulcer, colitis, hypertension, and so on (Malkin, 1991). Additionally, Selye (1936 and 1956 as documented in Malkin, 1991) briefly explains that there are enormously complex series of interactions among almost all systems of the body as a reaction to stress. Measurable and highly predictable physiological changes take place in the body as a reaction to psychological and environmental stress factors. The fact is regardless of where the stressor initially acts, it eventually produces a generalized stress reaction in the entire body. Stress causes a number of significant physiological responses including the release of numerous hormones, elevated blood pressure and heart rate, increased muscle tension, constriction of blood vessels, gastric disturbances, and suppression of the immune system (Selye, 1956 as documented in Malkin, 1991).

Investigations revealed that the least competent people are more sensitive to the environmental conditions than the healthy ones. Since physical illness, either mental or with sensory impediment for a period of time is considered as low competency, patients are more sensitive to the physical-settings that surrounds them (Andeane, 1991). Additionally, if the physical-setting has some negative conditions, patients become much more responsive which would obviously worsen their illness and recovery processes (Calkins, 1988 as documented in Andeane, 1991). Hennigar and Wortham (1975 as

reported in Sutherland and Cooper, 1990) demonstrates that stress is more likely to increase the heart rate of unfit and ill (physically and mentally) persons. Although Sutherland and Cooper (1990) suggested that stress is a subjective experience and the responses, outcomes and symptoms of distress may be physical, psychological and/or behavioral, people with physical and mental impairments are less tolerant and more vulnerable to negative environmental conditions and stress factors. Accordingly, they can be negatively affected (Andeane, 1991; Sutherland and Cooper, 1990). Due to these reasons creating stress free environments for a successful patient care is the most essential requirement of patient room design. Stress factors caused by design or related to design of room must be carefully explored in order to create psychologically supportive patient rooms.

3. 2. Environmental Stressors and Hospital Stress Factors

The fact is that the designers and hospital administrators have been trying to de-institutionalize the high-tech appearance of hospitals for many years. All efforts have been made to create appealing lobbies and patient rooms that provide the comforts of home. But very few facilities incorporate features that actively reduce stress (Tetlow, 1996). On the other hand, designing healing, supportive environment for a successful patient care is to some extent protecting patients from stressful environmental conditions.

Malkin (1991) suggests the environment or physical setting can often be a source of stress in health-care buildings. The fact that the design of environment causes stress by affecting person-environment fit (Zimring, 1981; Malkin, 1991; Deasy and Lasswell, 1985). A designer can better understand the sources of stress by viewing the facility through the patient's eyes.

In hospital environments, regardless of the nature of illness and length of patient's hospital stay whether it is short or long, the experience of hospitalization it self is a source of psychological stress for most of the patients (Deasy and Lasswell, 1985; Rachman and Philips, 1980). According to Malkin (1991), and Weiss and Baum (1987) beyond the environmental stress factors, being hospitalized and surrounded by illness is stressful, because it ultimately forces the patient to think about death and mortality. In its simplest form illness can be a major source of stress. A number of special conditions unique to hospitalization are responsible for considerable psychological stress. They include unfamiliar diagnostic tests and setting up an intravenous line, surrounding by people suffering from different diseases and so on. They all can be a frightening experience for all patients in every stages of recovery and well-being. A research conducted by Volicer and Isenberg (1977 as documented in Malkin, 1991) showed the differences between medical and surgical patients' reactions to the experience of hospitalization (see Table 3.1). In this research "A hospital stress rating scale was developed listing 49 events relevant to the experience of hospitalization. Researchers analyzed and controlled variables such as gender, age, marital status, education, previous hospitalization, and severity of illness in making comparisons" (15) says Malkin and adds that "surgical patients had higher stress scores relevant to unfamiliar surroundings, loss of independence, and threat of severe illness; medical patients scored higher on financial problems (worried if insurance would cover a long stay) and on lack of information " (Malkin, 1991:17).

Table 3.1. Hospital Stress Factors

Factor	Stress Scale Events	Assigned Rank	Mean Rank Score
1. Unfamiliarity of surroundings	Having strangers sleep in the same room with you	01	13.9
	Having to sleep in a strange bed	03	15.9
	Having strange machines around	05	16.8
	Being awakened in the night by the nurse	06	16.9
	Being aware of unusual smells around you	11	19.4
	Being in a room that is too cold or too hot	16	21.7
	Having to eat cold or tasteless food	21	23.2
	Being cared for by an unfamiliar doctor	23	23.4
2. Loss of independence	Having to eat at different times than you usually do	02	15.4
	Having to wear a hospital gown	04	16.0
	Having to be assisted with bathing	07	17.0
	Not being able to get newspapers, radio or TV when you want them	08	17.7
	Having a roommate who has too many visitors	09	18.1
	Having to stay in bed or the same room all day	10	19.1
	Having to be assisted with a bedpan	13	21.5
	Not having your call light answered	35	27.3
	Being fed through tubes	39	29.2
	Thinking you may lose your sight	49	40.6
3. Separation from spouse	Worrying about your spouse being away from you	20	22.7
	Missing your spouse	38	28.4
4. Financial problems	Thinking about losing income because of your illness	27	25.9
	Not having enough insurance to pay for your hospitalization	36	27.4
5. Isolation from other people	Having a roommate who is seriously ill or cannot talk with you	12	21.2
	Having a roommate who is unfriendly	14	21.6
	Not having friends visit you	15	21.7
	Not being able to call family or friends on the phone	22	23.3
	Having the staff be in too much of a hurry	26	24.5
	Thinking you might lose your hearing	45	34.5
6. Lack of information	Thinking you might have pain because of surgery or test procedures	19	22.4
	Not knowing when to expect things will be done to you	25	24.2
	Having nurses or doctors talk too fast or use words you can't understand	29	26.4
	Not having your questions answered by the staff	37	27.6
	Not knowing the results or reasons for your treatments	41	31.9
	Not knowing for sure what illnesses you have	43	34.0
	Not being told what your diagnosis is	44	34.1
7. Threat of severe illness	Thinking your appearance might be changed after your hospitalization	17	22.1
	Being put in the hospital because of an accident	24	26.9
	Knowing you have to have an operation	32	26.9
	Having a sudden hospitalization you weren't planning to have	34	27.2
	Knowing you have a serious illness	46	34.6
	Thinking you might lose a kidney or some other organ	47	35.6
	Thinking you might have cancer	48	39.2
8. Separation from family	Being in the hospital during holidays or special family occasions	18	22.3
	Not having family visit you	31	26.5
	Being hospitalized faraway from home	33	27.1
9. Problems with medications	Having medications cause you discomfort	28	26.0
	Feeling you are getting dependent on medications	30	26.4
	Not getting relief from pain medications	40	31.2
	Not getting pain medication when you need it	42	32.4

Source: Malkin J. Hospital Interior Architecture
New York: Van Nostrand Reinhold, 1991:16.

According to Malkin, the findings indicate that surgical patients are obviously aware of their illness and possible outcomes of treatment whereas medical patients do not get clear and enough explanations about these issues. Most important all, they are all negatively affected and stressed by hospitalization process. Hospital stress factors are classified by Malkin (1991) as an isolation from family and friends, lack of familiarity with the environment, medical jargon, fear of procedures, noise, inadequate lighting, loss of control, lack of privacy, comfort and control, worries about job or finances, and inaccessibility to information.

Another consideration with respect to hospital stress factors, is patient's maladaption to the hospital environment which can be expected to produce altered cardiovascular and endocrine responses associated with anxiety. It may negatively affect the course of an illness and impede the recovery. Senses (hearing, sight, smell, touch, and taste) and their ability to affect emotions is another aspect of hospital stress factors indeed (Malkin, 1991). A large body of experimental and clinical data has proved the powerful connection between biological responses to sensory stimulation. The data clearly demonstrate that the mind, brain and nervous system can be directly influenced, either negatively or positively, by sensual elements in the environment. For human beings, as biological regulatory mechanisms, to work properly continuous variations in the amounts of sensory stimulation are necessary to sustain their power to function. The adverse condition of permanent monotony induce pathological disturbances and psychological stress. Since, the drab interiors that many health-care facilities present to patients, families, and staff are monotonous, visually trying and emotionally stressful, especially to people already under stress, the design of environment related to sensory stimulation, which can cause psychological stress, should be appropriate for positive effects and under the control of

design team and all efforts must be done to eliminate negative effects them. It is obvious that the overall goal in design should be to reduce the patient's stress level. According to Gappell (1992), the human's physical and emotional well-being is influenced by six major environmental factors: light, color, sound, aroma, texture, space. These have such an enormous physiological and psychological impact on the individual that a well-designed medical facility properly applying these factors can be considered good medicine in itself .

In addition Saegert (1970 as documented in Malkin, 1991), summarizes environmental stressors in six category:

1. Physical threat: filth; heat or cold, exposure to element.

2. Stimulus information overload: negative only when it is unpredictable or uncontrollable. This would include on-the-job stress associated with high-performance careers: too many decisions to make, too much to do, too little time, pushing oneself too hard. this type of stress is rarely the result of the environment, but usually a characteristic of individual's relationship to the environment, based on personality type, cultural expectations or conditioning, and personal goals.

3. Suitability of environment: the ability of the environment to support or frustrate people's goals. An example, buildings with way finding problems create this type of stress.

4. Psychological and social: environments are coded with messages that convey feelings of social worth, security, identity, and self-esteem, as well as indications of status.

5. Demandingness of the environment: amount of effort, energy, or resources required to interact with it. This can mean physical effort, time, or money. An example might be stress associated with the cost of hospitalization.

6. Stimulus or information deprivation; occurs in isolated environments; to function normally, people need tension and challenge (15).

As a result, patients' psychological needs related to design or requirements of psychologically supportive room design include patients' ability to control the amount of interaction they have with others that is to say social contact, and visual privacy as well as acoustical privacy. In addition, noise control, control over the room, easy manipulation of environment, patients' need of personalization of space, odor control, and accessibility in room design are also important factors that dramatically increase patients' stress levels.

3. 2.1. Privacy and Social Contact

Beyond environmental ones, a lack of privacy is one of the hospital stress factors which has negative effects on patient's well-being and recovery. It usually rates high as a source of stress. According to a research carried out by the Center for Health Design, one of the critical design issues for keeping the patients happy in health-care settings is the design for visual and acoustical privacy (Tetlow, 1993). In designing healing environment, where patient's recovery and well-being is to be psychologically supported, privacy concerns should be considered very carefully and the design of a patient room should allow patient to control view of the outdoors and social interaction as well as the view of patient in adjacent bed (Malkin, 1991).

Privacy includes being able to control what patients can see and hear of others and also that others can see or hear about them. It is probable that hearing a discussion between a physician and another patient can be as disturbing as recognizing that one's personal conversations is heard by others. In addition, patients sometimes are required to be partially undressed due to the medical procedures in their rooms. In such situations one patient may accidentally be seen by another and it is certainly

embarrassing for both sides. Therefore, it is important to provide visual, acoustical as well as bodily privacy for patients in rooms.

Patients' need of privacy and social contact is an essential requirement of psychologically supportive design indeed. Carpman and Grant (1993) also suggest "the design must allow for visual, acoustical privacy, social contact and solitude"(10).

With respect to patient's need of privacy, one of the difficult aspects of hospital care for patients is that they suddenly find themselves sharing a room with one or more strangers. These people may be extremely ill, under the influence of powerful medications that induce unusual behaviors, suffering from nausea or violet retching and unable to control their urination and defecation. Even a well-balanced optimist, who spend a night before surgery with such a roommate, will be very depressed in the morning. So that providing privacy for each bed in shared rooms should be considered as a critical issue in design (Deasy and Lasswell, 1985).

Studies show that territorial intrusions produce anxiety and stress for patients whereas intrusions of personal space are not. In other words, being touched by caregivers at close range is not stressful, but the presence of strangers and intrusions into the room are a cause of stress (Malkin, 1991). In hospitals, a large number of private rooms have been as solutions to fulfill patients' need of privacy. According to Deasy and Lasswell (1985) there must be enough private rooms provided for most patients. Because, obviously most patients will avoid stress and frustration, if they have private rooms. However, there will be those who would prefer to share a room, particularly if they have financial problems. Recently, some newer hospitals offer all private rooms. A study carried out by the University of Michigan

Hospital reveals that even if the cost were no object, 45 percent of patients would choose a semiprivate room, and 7 percent would prefer a shared room (Carpman, Grant and Simmons, 1986 as documented in Deasy and Lasswell, 1985). In other words, many people seem to prefer having someone to talk to. The fact that privacy and social interaction are linked together, because in a sense they are on continuum. There is enough data on behavior pattern in humans to suggest that both are necessary for any quality of life. However, there is a controversy about private versus shared rooms. Generally, mix is the most appropriate one. There are some patients who do benefit from positive aspects of having a roommate. But in general, unless the rooms are designed in such a way that each person has clear territory and opportunity for privacy, private rooms allow more privacy and personal control (Calkins, 1992). Another study in which patients were randomly assigned to single and private rooms revealed that more disturbance among patients in private rooms, which were attributed to reduced sensory stimulation and social isolation (Williams, 1988). Deasy and Lasswell (1985) suggested that there are people who find shared rooms interesting and some, perhaps, who might be encouraged by the thought that at least they are better than their roommate. For most adults, however, shared rooms are an unusual and unattractive aspects of hospital care. Thus, issue of privacy is a complex one and perhaps should be interpreted as a need for control rather than the desire to be alone (Malkin, 1991). In addition to single rooms, there are some other ways to provide privacy. Table 3.2. displays some of the architectural options used to foster a range of patients' behaviors, from isolation to interaction (Carey, 1986).

Table 3.2. Architectural Ways and Equipment that can be Used for Isolation and Social contact

Privacy	*Community*
Acoustic screens/curtains	Movable screens/curtains
Handicap access	Handicap access
Single-bed rooms, baths	Multibed rooms
Quiet rooms	Noisy rooms
Adaptable spaces	Adaptable spaces
Private areas, rooms	Group areas, rooms
Zoning and orientation	Zoning and orientation
Personalized areas	Personalized areas
Outdoor plantings	Outdoor patio space
Nooks, stopping places	Vistas, amphitheaters
Single activity rooms	Group activity areas
Transition areas	Transition areas

Source: From Carey A.D. Hospice Inpatient Environments New York: Van Nostrand Reinhold Company, 1986: 216

In addition, supplementary equipment can be used to provide privacy and interaction, such as: earphones, telephones, television, bulletin boards, microphones, closed-circuit television. Elements that are repeated in both columns, indicating that the same element can provide either privacy or community depending on how it is used, such as the adaptable space, that can be used by groups and individuals at different times (Carey, 1986).

The design of a patient room should provide privacy, comfort, and easy interaction for patients, visitors and care givers. Although single rooms are proper for privacy and commonly found in acute-care units, sometimes they are not appropriate for all acute patients. Shared rooms increase the patients opportunity to interact. Besides, social contact is as important as privacy. "Privacy and social interaction are linked together, because in a sense, they are on a continuum" says Calkins and adds that "we need to look at how people can menage and control opportunities for each one" (Calkins, 1992:20). As one solution Carey (1986) recommends toe-to-toe

bed arrangement, which permits easy patient discourse as well as screening. Another example of architectural option for privacy as well as interaction is the use of nooks and community room and lounges all over the nursing unit .

3.2.1.1. Noise and Acoustical Privacy

Jones (1983) describes noise as unwanted sound which is one of the most significantly hazardous environmental factors known to cause physiological changes in the body and has impacts on well-being and recovery. It affects the senses and also, stress level(s). It is one of the most serious deterrents to healing and a major source for psychological stress. Many studies have demonstrated that noise has negative psychological impacts on humans (Cooper and Kelly, 1984; Smith et al., 1978; Sutherland and Cooper, 1990). It can cause auditory trauma, generalized stress reaction, physiological changes in blood capillary structure. It also impedes the flow of red blood cells and constricts the vascular channels which cause high blood pressure, heart disease, and ulcer (Malkin, 1991).

As an environmental stressor, noise causes headaches, irritation, fatigue and frustration, aggravates anger, and reduces pain thresholds. It increases arousal levels and causes some psychological imbalance (Sutherland and Cooper, 1990). Noise, as a source of stress, impairs hearing acuity and affects visual perception and diminish learning capacity (Gappell, 1992). Venolia (1988) states:

> In addition to hearing loss, a complex and growing list of ills is being blamed on noise. The body responds to noise with high blood pressure, headaches, tension, hyperactivity, poor digestion, ulcers, fatigue, cardiovascular disease, decreased immunity, neurological disorders, and disturbed sleep. Irritability, lack of concentration, moodiness, poor work performance, and mental disturbance can also result (86).

According to Weeks (1996) noise pollution has been designated as the most common health hazard. Loud, disturbing sounds, can create unhealthy rises in all humans' vital signs and cause extra fat in blood.

In hospital environments sound can be negative for patients, if it is perceived as noise and can not be controlled. Sound perceived as music can be positive and be therapeutic. Venolia (1988) views music as a powerful tool and states that "Music has the potential to relax us and to reach beyond our analytical minds directly into emotional centers. Carefully created and selected music can aid relaxation, concentration, creativity, meditation, muscle response, digestion, mood, healing, and supportive mental states" (96). Many other researches showed that music can help patients to calm the feelings of stress. It also facilitates problem solving, study more effectively, stop procrastinating, exercise more easily and assist mind-body healing (Weeks, 1996). It is possible to produce physiological change, control heart rate, and lower blood pressure by entraining music to the rhythms of the body. Music can also be a conditioned stimulus for relaxation and pain reduction and a distraction from discomfort (Gappell, 1992). The USA Today, May 30, 1991 describes a research study by doctors at the UCLA Research Center at Camarillo State Hospital. They found that schizophrenics are less likely to hear imaginary voices if they hum softly. Evidence indicates that patients who hear voices are using speech muscles without producing sound, and somehow that triggers hallucinations. Of the 20 participants in the study, 59 % had fewer hallucinations. Another research reported by the July 12, 1990 issue of Newsweek, shows that downtown businesses in Edmonton, Alberta are playing Bach and Mozart in a city park to discourage drug dealers and their customers. Police reported a dramatic drop in drug activity (Weeks, 1996). Music is thought to affect the limbic system, deep areas of brain tissue that produce sensations of extreme

pleasure. It can also have an analgesic or pain killing effect. It can lower blood pressure, heart rate, and the amount of free fatty acids in the blood, potentially reducing the risks of hypertension, stroke, and coronary heart disease. Music can be used as therapy in nursing units in order to help patients to discharge feelings of anxiety, stress and fear (Gerber, 1988 as documented in Malkin, 1991).

Any attempt to reduce stress on hospitalized patient and answer his or her psychological needs related to design must include noise control. The fact that, noise is one of the most harmful of environmental stressors; it produces a generalized stress reaction that can increase blood cholesterol levels, increase the need for pain medications by lowering an individual's pain threshold. It also keeps the brain stimulated so that the patient cannot rest or sleep which impedes healing. In a study it has been concluded that noise levels in the recovery room can be exceedingly high because of the density of patients and conversations among staff and that noise may have adverse effects on the patients taking certain antibiotics which could be disruptive of sleep, and enhances the perception of pain (Falk and Woods as reported in Olds and Daniel 1987).

In hospital settings, acoustical considerations should be under the control of designing team and efforts must be done to anticipate sources of noise and find ways to diminish them. "Noise control is an obvious requirement of psychologically supportive environments that foster recovery" says Malkin and adds that " In healing environments acoustic criteria cover sound of footsteps in corridor, slamming doors, clanking latches, loudspeaker paging system, staff conversations from nurse station or staff lounge, other patients' televisions and radios and clanking of dishes on food carts (Malkin, 1991:36).

Due to the fact that a lack of acoustical privacy can be stressful for patients providing acoustically private patient rooms is required. Acoustical privacy is described by Carpman and Grant (1993) as the ability of a patient and family to talk together without being heard by others and without being disturbed by someone else's conversations. According to Rettinger (1988), "It is the absence of undesired audible and tactile signals into one's quarter, whether they originate on the street, the sky, or the enclosures adjoining one's domicile horizontally or vertically" (158).

Creating acoustically private interiors in shared rooms is obviously more difficult than in private rooms. For shared rooms, Deasy and Lasswell (1985) recommended using sound proof separations between beds. Proper sound absorbing fabric materials can be selected for the privacy curtains. Acoustically isolating spaces for each bed are required in shared rooms. A draw curtain that is commonly used between beds for visual privacy may not be proper tool for ensuring acoustic privacy. Visitor lounges can be alternative spaces for families for private conversations (Malkin, 1991; Carpman and Grant, 1993). In addition, the acoustic environment can be improved by selecting interior surfaces and furnishings that do not reflect or amplify sound waves. Walls and ceilings that are irregularly recessed are effective in scattering sound waves. Although surfaces and furnishings can have varying sound absorbing qualities, an area with adequate amounts of carpeting, fabric, wood, acoustic tiles, and sound panels can provide a quieter environment (Gappell, 1992). Intensity of noise can be reduced by using such materials. Sound-absorbent materials should be selected in design of patient rooms. Soft, porous materials like carpets, upholstery, drapes, heavy textile wall hangings, and acoustical tiles will reduce noise levels. Of course, non-porous surfaces such as plasters, glass, concrete, and sheet plastic that reflect sound must be avoided in the environments

where noise is a problem (Venolia, 1988; Rettinger, 1988). Malkin (1992) suggests a designer can introduce sound-absorbing materials on all wall, floor, and ceilings; and fabric-wrapped acoustic panels and ceiling tiles with a high noise-reduction coefficient. According to Carpman and Grant (1993), sound-attenuating material between the patient's rooms (such as wall insulation) and within rooms (such as carpeting and other sound-absorbing surfaces) should be used for achieving acoustical privacy. Noisy activity areas should be placed away from patient rooms. Carpman and Grant (1993), also summarizes design guidelines for achieving acoustical privacy as "Use sound-attenuating materials in patient room walls. Consider use of fire-retardant, easily washable wall fabrics to muffle sounds and protect walls from wheelchair abrasion. Locate only quiet functions near patient rooms. Acoustically contain the nurse and physician work areas on patient floor" (163).

3.2.1.2. Visual Privacy

In patient rooms, a door or an interior window provides an opportunity to people-watch and allow nursing staff to monitor the patient without having to walk into the room. In this sense, an interior window is a visual link between patient's restricted room and the busy corridor. While looking out, patients may feel more a part of the rest of the hospital and enjoy the opportunity to people-watch. It can be pleasant for patients and useful for nurses (Malkin, 1991; Carpman and Grant, 1993). It is essential that the interior windows must be arranged not to impede occasional observation of the patients by nurses (CIBSE, 1989).

With respect to visual privacy, there is always a contradiction between the patient and staff preferences with which the patient can see into and be seen

from corridor. Patients generally like having a view into hallway or corridor, but they do not necessarily want people looking in on them. Malkin (1991) stated that when given a choice, patients preferred the bathroom on the hallway wall, in order to maximize the exterior view and minimize the observation of the passersby. If the bathroom is located on the hallway and in between the patient bed and the hallway, then patient's head will be blocked from the view. In this case, privacy efforts for patients result in a lack of visual access for the nurse. Patients generally like an interior window, only if they can control the shade or window covering. In order to maximize the patient's control over visual privacy, the window must have a drape to provide privacy when needed or use glass such as varilite vision panels by taliq which turn opaque at the flick of a switch that is controlled at the patients' bedside. It is important to provide the patient by the means that can ease to manipulate the covering over the interior window (Malkin, 1991; Carpman and Grant, 1993). Cubicle curtains are also used for privacy purposes within the patient rooms. It is found that, cubicle curtains are pulled for a variety or reasons, including using the bedpan, being examined or treated, dressing or undressing, sleeping, receiving a bed bath, talking with visitors and blocking out light. Although few patients in this study thought the cubicle curtain provided much privacy, being able to manipulate it was very important for them. Motorized curtains which is easy to manipulate without leaving bed can be used. They can be operated by staff and yet they free the staff from having to continually open and close curtains (Carpman and Grant, 1993).

Arrangements of beds within a shared room may also affect the visual privacy of patients. Carpman and Grant (1993) stated that the patients prefer to have the foot rather than the head of their beds positioned in line with the doorway. They do not want to be viewed by everyone passing by.

Beds are facing each other (toe-to-toe) or placed next to each other (side-by-side) arise privacy, choice and territorial problems. In the same, patients also prefer the side-by-side arrangement because they have to look at each others in the toe-to-toe room arrangements. Major disadvantages of the side-by-side room arrangement is that one patient would tend to claim the window as his or her territory, and the other patient would tend to claim the door area. The fact is that the layout should allow the patient to control his or her privacy and territory which are provided more properly by the toe-to-toe room arrangement rather than the side-by-side type (Carpman and Grant, 1993).

Although the toe-to-toe arrangement provides more equitable territories, some respondents did not like the idea of patients facing each other. Some patients said that they would not want someone staring at them all the time. Others pointed out that one patient's light might shine in the other's eyes. Combining the best features of side-by-side and toe-to-toe arrangements in trapezoid or diamond-shaped rooms, where beds are positioned at 90° to one another (see Figure 4.2.). In these designs, both patients have equal access to door and window (Malkin, 1991; Carpman and Grant, 1993).

With respect to visual privacy Carpman and Grant, (1993) presents a number of design elements to be considered:

1. If a window is located between the patient room and the hallway, provide the patient the means to easily manipulate the covering over the window.

2. If a side-by-side, semiprivate room scheme is chosen, be attentive to patient complaints regarding the lack of view from the window for the bed closer to the hallway and lack of clear territory for visitors.

3. If a toe-to-toe semiprivate room scheme is chosen, enable patients to control their views of each other, and make sure that the bed light of one patient does not shine in the eyes of the other.

4. To maximize the outside view and to maximize visual intrusion by passerby, locate the bathroom on the hallway wall rather than on the exterior wall.

5. Place the doorway in line with the foot of the bed, rather than in line with the head of the bed.

6. Consider providing motorized cubicle curtains in areas other than Intensive care units where patients are most likely to be non ambulatory and hospitalized for extended periods of time (163).

3.2.2. Personalization of Space

Malkin (1991) stated that many factors have to be considered in the creation of a psychologically supportive environment. Also, she suggested that providing a place for patients in order to display their personal mementos is one of those requirements to be carefully taken into account in designing a patient room. In this sense, fulfillment of patients' need of personalizing their spaces is essential and critical issue in patient room design.

The fact is for most of the patients, especially, in their first experiences in the hospital, fear, isolation and helplessness feelings occur. Because a patient room whether it is shared or private is generally an unfamiliar and strange environment with its institutional design character and sterile chemical smells. Patients are psychologically influenced and get stressed and these have negative effects on their recovery process. Giving opportunity to personalize their spaces in rooms will not only reduce patient's stress, his or her sense of helplessness and carelessness in a strange hospital room, but also prevent some territorial problems in shared rooms. In addition, patients no matter how short their hospital stay are generally accustomed to bring along some small items and personal mementos with them in order to make

the environment more familiar, pleasant, non-institutional and less stressful. Visitors also have a tendency to bring some things to keep the patient happy. In addition, "while the functional requirements of health care delivery come first, once they are satisfied, there is no reason why the hospital room should not be as enjoyable and attractive as possible" (115) says Deasy and Lasswell (1985). They also suggested that the appearance of a patient room and the degree of patients' need are taken care of tells the patient something about the hospital concern and attitude. If there are convenient places for the things people bring with them, the patient will less likely to feel like another statistic in the hospital computer. Such progressive care environments certainly encourage faster recovery. On the other hand, in environments where healing is to be supported physiologically, mentally, emotionally and spiritually, patients' need related to personalize their environments must be satisfied. In other words, patients should have some means of displaying whatever personal mementos have meaning for them.

Designing psychologically supportive patient room include, among the other things is establishing a sense of space. Typically, individual meaning is given to a place when territory is established with personal articles, belongings and mementos. The fact is the smallest event can take a great meaning for patients even though the acute-care requires a short-term hospital stay. The design of rooms can encourage and foster medical care and action of choice, comfort, privacy and socialization. Having a place for display personal mementos makes the environment more familiar and non-institutional meanwhile supports positively patient's psychology (Carey, 1986). It is obvious that the patient's room is temporary a home for most of them during their hospitalization period. So patients should have enough space for displaying cards, flowers, or any other personal mementos that they choose to have with them (Deasy and Lasswell, 1985).

3.2.3. Personal Control over the Room

Solomon (1996) asks the question of "what types of control can be given to the patient in health care environments?" and declares that "It's now known that patients who can control their own pain medicine by pushing a button for the morphine drip in lieu of having to push a nurse call button usually require much less effort "(82). As he mentions that the level of input is important and the degree of control given to patients for directing their own medical treatments are questionable and, also, it will be the subject of future investigations, he and several researchers, health care administrators, and designers suggest that patient's control over the space in a patient room is very enhancing and psychologically have stress reducing effects on patients. Studies have shown that a sense of control is critically important for maintaining emotional and physical health. Failure to facilitate control over one's own activities induces stress, cause hormonal changes, and affects immunologic competence. Therefore, a physical setting that compensates for disabilities will cause a strong positive effect on stress reduction (Malkin, 1991).

The fact is patients' psychological and physical comfort to some extent depend upon the degree of control on their environments. Patients should have ability to manipulate their own environments easily and position themselves comfortably within it. Psychologically supportive design should allow patients to have several means of control over the room. All facilities and equipment provided in rooms for instance nurse call button, reading light and ventilation control, window blinds, TV, and radio controls can be easily reached and controlled by each patients without any limitations given by the others. This is the obvious problem of patients especially in shared rooms

and such territorial problems may be a source of friction and stress (Deasy and Lasswell, 1985).

In addition, a supportive room design should encourage patients to do as many things for themselves as they can do without any obstruction caused by the others. Self help of this type helps the staff to some extent, but more important than this is to help patients retain a feeling of competence and independence. On the other hand, if a patient is allowed to share all equipment and environmental facilities with another, he may be forced to for instance, watch the channel or listen the music that he does not want to view or hear. This can be very stressful which negatively affects his or her recovery. Therefore providing complete facilities for each bed specially in shared rooms is necessary. Shared rooms often arise territorial problems for patients. In order to reduce such problems in shared room, each bed is required to have its own set of light, ventilation control, telephone, nurse call button, dimming and other means of controls (Malkin, 1991; Deasy and Lasswell, 1985). According to Gappell (1992) placing controls for nurse call, lighting, television, and radio with easy reach of patients enhances self-reliance and increases patients safety. In addition, patients in shared rooms should have equal access to controls.

3. 2. 4. Stress and Olfactory Factors

Although people often do not pay attention to smelly affairs of environments, odor is one of the psycho-environmental determinants of places that constitute the ambiance as well as image. Gappell (1992) state that "Scent may be called the silent persuader, influencing mind, body, and health. Smell, the oldest and deepest of the senses, is also the most evocative, recalling complete memories" (128). The smell of the environment arouses

psychological and emotional responses and all people are sensitive to odors like other sensory stimulation. Human preferences and responses for odor are changeable depending upon their own learned associations, sex, education, age, culture, experience, and setting (Spivack, 1984).

According to Gappell (1992) and Malkin (1991), human physiological and emotional well-being is influenced by six major environmental factors and one of them is aroma whether it is pleasant or odious. It certainly affects the adaptation process of patients to the room environment. Because smell is directly associated with memory, it has great psychological and physiological impacts on patients. Emotions and smell are very closely interrelated. Its ability to affect emotions must be best considered as another aspect of hospital stress factors. Since people with physical or emotional impairments are more sensitive to environmental and psychological stress factors, odor control is essential in a hospital patient room. One study for measuring the human responses to the smell of the environment was conducted in the medical-surgical unit at Pacific Presbyterian Medical Center, San Francisco. The findings showed that a nearby kitchen located in nursing unit, where patients and visitors may bake cookies and prepare any type of food, changed whole atmosphere of the patient care area. All inhabitants stated very positive comments about the aroma of chocolate chip cookies moving down a hospital corridor (Malkin, 1991). The fact is unpleasant smells increase breathing and heart rates whereas pleasant smells are stress reducing. Therefore, in patient care areas odor control is required, because odor can cause extra stress on patients who are already stressed by hospitalization.

According to Spivack (1984), olfactory concerns, odors and control requirements are commonly ignored in building designs. However, these

issues must be essentially considered in hospitals, schools and such places where inhabitants are more vulnerable to negative environmental conditions. Hospital smell may evoke negative emotions and have immuno-suppressive effects on patients (Solomon, 1996). "Hospitals and all medical settings are strong odor generators" stated Spivack (1984) and added "Anyone who has the experience of being a patient, with the consequent discomfort and anxieties of that status, is immediately thrust into remembered or referred anxiety upon entering the hospital and smelling its air" (200). He suggested that because illness can cause extra sensitivity to odor, and in patient rooms odor control is important to reduce the patients' feeling stress from the environment. In addition, the odor control must be provided in bathrooms and other potential spaces where distinct odors may strongly be dominant. Deasy and Lasswell (1985) indicated that the patient rooms must be odor free. The smell of disinfectants, medications, and bedpans have nothing to foster the patient's sense of well-being, but worsen it. The air in patient rooms certainly should not smell.

With respect to odor control, there must be efficient ventilation systems provided in patient rooms and bathrooms. According to Spivack (1984), the odor can be controlled easier at its source rather than in air. In addition, Malkin (1991) mentions that bowls of sachet, floral arrangements, and plants can provide pleasant smells in patient environments. Besides, there is another benefit of plants which is cleaning the indoor air. As well as cleaning the indoor air, real plants provide the needed touch of nature.

4. PHYSICAL AND FUNCTIONAL ASPECTS OF A HOSPITAL PATIENT ROOM DESIGN

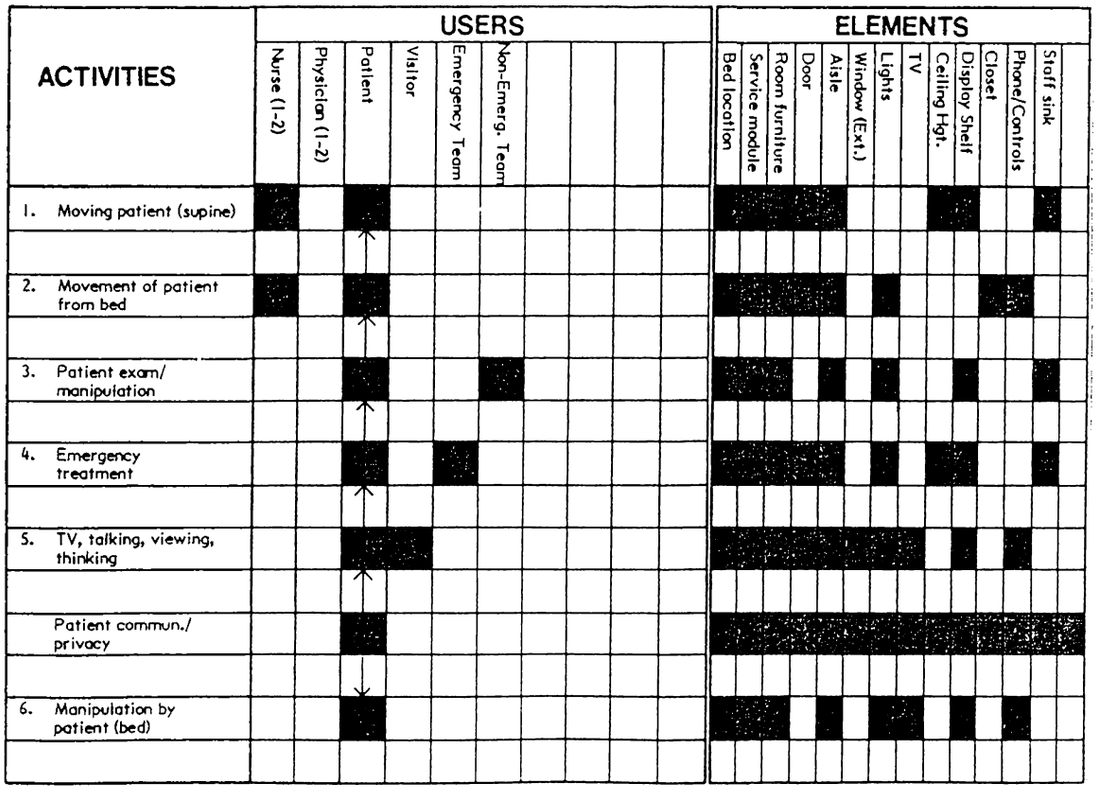
In addition to psycho-spatial design considerations, creating a therapeutic patient room environment includes physical and functional aspects related to a room design. In other words, components of a physical setting should be planned or arranged in order to support health care activities and equipment, medical treatment, recovery and healing process of the patients both physically and functionally. In this manner, size and layout of a patient room and a patient bathroom, proper patient room furniture and design considerations, accessibility concerns related to a patient room and a bathroom, color and its use in a patient room, light and various lighting considerations, heating, ventilation and air conditioning systems and materials that are suitable for a patient room design will be discussed in this chapter

4.1. Size and Layout

Space, as an environmental factor can control its users and particularly in a patient room, size and layout can strongly enhance, assist or impede the medical care delivery and affect patients' health (Gappell, 1992; Carpman

and Grant, 1993). Designing an optimally sized patient room is important because a patient's life may depend on the ability of care givers to perform emergency procedures in the patient rooms. Another reason is that if the room size is increased particularly in a linear race track design, the length of corridors and medical support zone between the two rows of patient rooms are automatically increased (King, Marans and Solomon, 1982). On the other hand, it is difficult to give clear dimensions for a patient room size due to the fact that it depends on various factors such as the number of inhabitants, the privacy concerns, type of the room layout, the government regulations, and the hospital architectural design. For instance, if the size of the patient room increases, the quality of social interaction between patients changes from active to passive. The smaller the room, the greater the sense of privacy experienced by patients and the freedom of choice for alternative behaviors (Ittelson, 1970 as reported in Spivack, 1984). Beyond various such factors, in designing optimally sized patient rooms the most important determinant is efficiently functioning of users in the space. According to King, Marrans and Solomon (1982), a patient room whether it is shared or private must permit various technical and functional requirements of patient care delivery and activities of care givers such as the emergency treatment of a patient having a cardiac arrest by the medical team. In other words, there must be adequate circulation space for the medical emergency team and the equipment to have access to patients. Palmer (1996) also points out the necessity of creating sufficient patient room size in order to accommodate at least two caregivers, simultaneously. For designing an adequate room size, it is important to figure out how patients and care givers function or perform their activities in the room. The full range of activities in patient room for different user groups is demonstrated in Table 4.1. The activities of the user groups are considered in relation to the room elements and relationships are organized in a matrix form.

Table 4.1. Patient Room Activity Pattern



Source: King, J. Marrans, R.W. and Solomon, L.A. Pre-Construction Evaluation. Ann Arbor: The University of Michigan, 1982:9.

An optimally sized patient room design must include a wardrobe, a bedside stand, an overbed table, a patient chair, and a visitor chair and a patient bed. Additional space-related needs of patients and visitors must be satisfied as well. Patients are generally brought into the room on a stretcher or in a wheelchair to be transferred to the bed. Easily maneuvering of these equipment in the room without any obstruction caused by room elements is important. There should be enough space and unobstructed circulation area to provide access for wheelchairs, rolling intravenous poles, or walkers. For the movement of the patient from the bed, the nurse should be able to help the patient from both sides. Assisting activity should not be obstructed by

any related elements given in Table 4.1. Therefore, sufficient amount of space must be provided at the foot of beds and between the beds and bathroom walls in both single and shared patient rooms. This is evident, especially, during emergency situations and when patients are moved in and out of the rooms. There should be circulation area around the beds so that visitors can place their chairs on either side of the patient's bed. Especially in a single patient room, there must be enough space for overnight accommodations as well. A sleep chair or multi-position recliner, or a cot can be used in a single patient rooms.

The room door must be able to be opened fully without any obstruction. An open aisle is required and there must be sufficient space provided between privacy curtains in shared rooms. If there is a staff lavatory, it must be conveniently located not to cause any problem in the emergency activities. The location of headwall unit must be accessible from both sides as well. The location and the height of TV sets, flower shelf, wallboard or other room elements must be suitable for patient use and should not impede the movement of either staff or equipment. Additionally, sufficient space in which a patient in a wheelchair could maneuver must be provided in patient bathrooms and the lavatory must be suitable to patient use. It should not be very small or large for the space (King Marrans and Solomon, 1982).

With respect to patient room layout, Malkin (1991) suggested different alternatives to fulfill different objectives. In other words, each room type has its own disadvantages and advantages. For instance, if the bathroom is placed on a corridor wall, it may block the observation of patients, but provide maximum exterior view. Toe-to-toe patient room layout, in which beds are placed on opposite headwalls gives both patients equal window access and permit maneuvering of the equipment easier. It provides easier

outlined territories and gives privacy to patients rather than side-by-side room layout. The disadvantage is that patients are forced to look at each other, while the privacy curtains are opened. When beds are placed side by side in the room, the bed on the corridor side does not have equal access to window as the other one. Visitors of the window bed patient are also forced to intrude the privacy of the other patient (see Figure 4.1.)

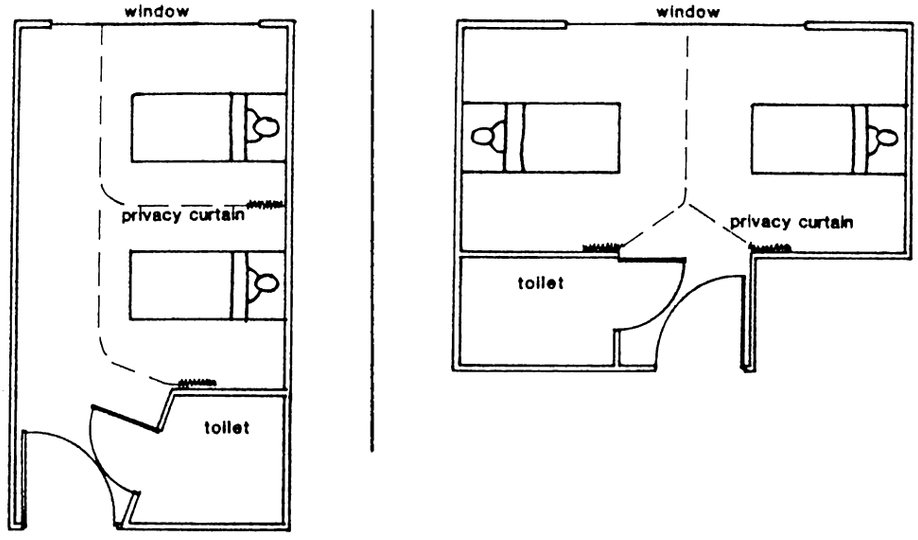


Figure 4.1. Side-by-Side and Toe-to-Toe Room Arrangements
(From Carpman, J.R. and Grant, M.A. Design That Cares.
American Hospital Publishing, 1993:162)

In effort to eliminate disadvantages of toe-to-toe and side-by-side room layouts, there are currently new patient room designs are preferred (see Figure 4.2.). They are trapezoid or diamond-shaped rooms where patient beds are placed at 90 degrees to one another (Malkin, 1991).

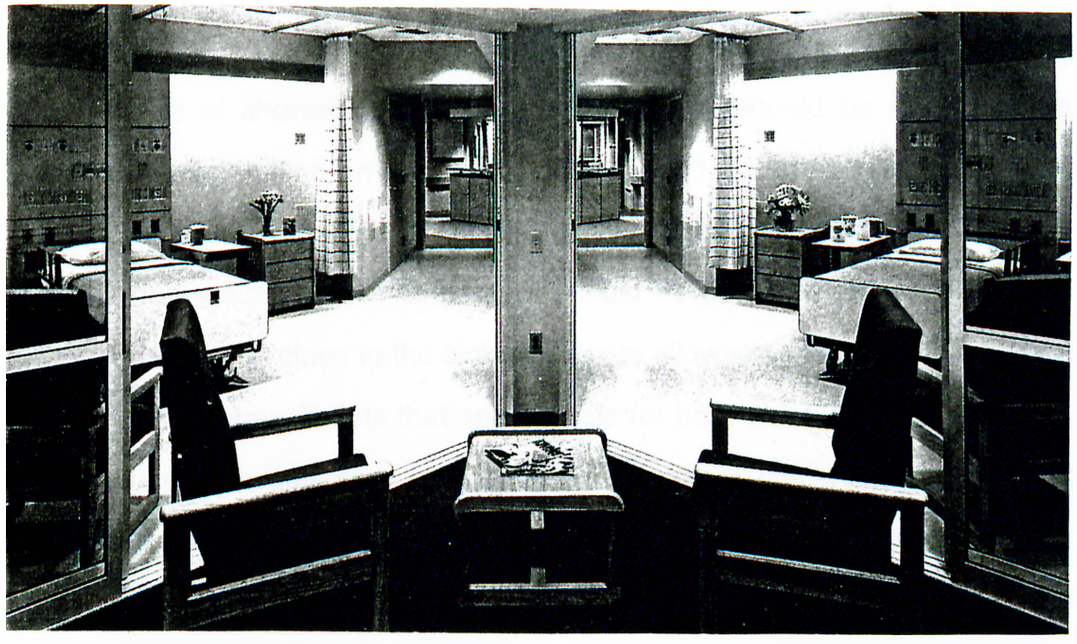


Figure 4.2. Two-Patient Room with shared Area
(From Malkin, J. Hospital Interior Architecture
New York: Van Nostrand Reinhold, 1991:81)

In designing a patient room, there should be an adequate space provided for a patient bathroom as well. Due to the physical impairments of most acute-care patients, there are some certain requirements to be taken into account in a patient bathroom design. Key considerations of the bathroom design simply cover safety, wheelchair accessibility and nurse assisting concerns. There are three critical areas that should be carefully designed in a patient bathroom: a sink area, a shower area and a toilet area. In the sink area, there should be a mirror, an adequate storage space, a trash receptacle, an electric outlet and a towel rack provided for patients. Placement of these items should be suitable for both wheelchair users and ambulatory patients. Sinks that can be used by both a wheelchair user and an ambulatory patient should be selected. In the shower area, there should be an adequate space for a portable seat for those who can not stand while showering. The space should be large enough to accommodate two nurses for assisting the patient. There should also be grab bars in the shower area for supporting

the patient while rising from a shower seat and transferring to a wheelchair. Placement of shower controls and a towel rack should be accessible for those who are sitting on a shower seat. In the toilet area, there should be an adequate space provided in front of the toilet for a wheelchair approach and a nurse assistance. Grab bars should be provided as well. The toilet should be placed close to the sink in order to allow patients to use both items at the same time. Toilets that are suitable for both elderly and a wheelchair user should be selected. Items, like toilet paper dispenser and flushing levers should be easily reached by patients while sitting on a toilet. Most important all, nurse emergency call cord should be placed accessible to areas (Grant and Carpman, 1993).

4.2. Patient Room Furniture

Most commonly, patient rooms are unfamiliar and strange environments with a little variety in settings and few choices for patients to sit or lie down during the day. Palmer (1996) suggested that unfamiliarity of the patient rooms can be eliminated by using comfortable and attractive furniture settings. In addition, a patient room furniture must be suitable to function activities of health care delivery and patients' needs related to physical design. In selection and design of patient room furniture, durability, easy maintenance, movability are important. Furniture must also, be light in weight with non-porous exteriors (Jackson, 1993).

Patient's bed and chair are the most typical design elements used in hospital rooms. Due to the fact that the design of furniture directly affects the patient's sense of comfort during hospitalization, there are some considerations to be taken into account in the selection the and design of these pieces of furniture (Palmer, 1996; Carpman and Grant, 1993).

Patients often have to spend long periods of time in bed. Therefore, having an access to variety of activities without getting up is important for them. With respect to the sense of comfort, patient's ability to adjust the bed, move overbed table for eating, manipulate the bed for a comfortable sleeping activity; and adjust it for reading, talking and watching television with maximum ease is important. Additionally, beds should be adjustable in order to reach, dial and hold the telephone. To perform all these tasks, various buttons and switches for the manipulation of a bed must be easy to understand. All control buttons (for bed, nurse call, light and television) should be lighted for nighttime use and they should be easily operated and understood by the patients who are lying flat or sitting up right. Due to the fact that one hand may be injured, controls should be operable with either hand. Additionally, pressure-sensitive control buttons should be preferred for patients who have difficulty in hand manipulation. Ergonomic considerations must be taken into account for bed controls, because ergonomics certainly increases patient's safety, health, sense of comfort and control while improving human performance (Carpman and Grant, 1993).

A patient chair as a typical design element used in patient rooms provides an additional place for reading, eating and watching television. A visitor may spend long periods of time sitting on a chair for talking or watching the patient sleep. If appropriate, sleep chairs or multi-position recliners can be used. Patient chairs which allow users to elevate their feet should be preferred or additional foot stools should be provided. Covering materials should be easily cleaned as well as comfortable to sit on. According to Jackson (1993) materials such as linoleum or laminate and upholstered chair pads are convenient for patient room chairs. Removable seat covers, moisture-proof pads should be preferred in regarding to maintenance

concerns (Zelinsky, 1992). Additionally, chairs that provide extra comfort and physical support should be preferred. They should have sturdy and comfortable arms and can be moved easily. To accommodate heavy patients wide chairs should be selected. Because the size weight and physical condition of the patients differ, the chairs which can adjust to satisfy numerous support and configuration demands should be chosen (Carpman and Grant, 1993).

A wardrobe as one of the furniture requirements of patients room provides storage for belongings. Hospitalized people generally have a tendency to bring clothes and many personal possessions with them to make the strange environment more homelike and familiar. Therefore, providing an adequate storage is necessarily important. A patient wardrobe is required to have enough space for patient's belongings. On the other hand, there should be adjustable clothes rod, a lockable drawer, clothes hooks, and space for suitcase, shoes, and boots in it. There should be space available to store toiletries such as a comb, brush, toothbrush, shaving equipment, shampoo, deodorant, cologne or aftershave lotion, makeup, and lotion. Patient wardrobe should have enough capacity to store winter outerwear, shoes or boots, some clothing, underwear, a suitcase, and other small possessions. A few hooks should be available inside the wardrobe for bathrobes and other clothings. Opening and closing hardware that are selected should be used easily by people with arthritic hands or limited dexterity. Clothes rod should be placed at a height that can be reached by wheelchair users. It should be adjustable to be used either at wheelchair or standing height (Carpman and Grant, 1993).

Additionally, shelves for flowers and personal articles, a tackboard for displaying greeting cards, and additional space for storage of reading and

writing materials or knick-knacks and food must be provided in patient rooms. Hooks for visitors' coats should be located either behind the door or in some other unobstructive location. Otherwise, these items will get in the way of care givers and impede them to work efficiently. Shelves should be wide enough and have vertical clearance to accommodate larger flower arrangements. In addition, corners must be rounded as well. An adequate storage area for a hair dryer or a shaver should be provided in a patient bathroom as well (Carpman and Grant, 1993).

Overbed tables that patients with arthritis or limited dexterity can easily adjust to various heights should be selected. Overbed table should be stable and not be tipped over easily. There should be storage space inside the overbed table and space should be easily reached from both sides. There should be adjustable mirror in overbed table that can be easily used from either side. Manipulation of the drawer and mirror should be appropriate for people with arthritis or limited dexterity (Carpman and Grant, 1993).

Bedside stands can be moved easily so that bedridden patients can reach the top surface and drawers. Drawers can be opened easily by patients with arthritic hands or limited dexterity. All storage areas need to be designed for patients' special access needs. Handles on drawers need to be easy to grasp. Drawers and doors should be opened with a little effort (Carpman and Grant, 1993).

A patient television is another design element of patient rooms. Television provides company and helps patients to pass time and distract from their problems. It also provides a social activity that patient can share with family and friends. For many patients, television's availability in the room is much more important than the type of programs watched. Generally two types of

television sets are commonly used in patient rooms: large wall-mounted or ceiling-suspended models and small, personal-size models that are suspended on arms. Both have advantages and disadvantages. Nurses and patients preferences are compared by a study conducted by the Office of Hospital Planning, Research and Development of University of Michigan. In this study, patients were grouped according to their stated preferences and 40 percent of patients chose the wall-mounted television whereas 37 percent selected the arm-mounted television. The rest, 23 percent could not decide which was preferable. Wall-mounted type was strongly preferred by nurses, because it did not get in their way as much as the small did. The large televisions provided an advantage of viewing by groups and it was easier to see. Some patients claimed that the large televisions less preferable, because it was difficult to watch in a comfortable position, especially when their physical condition did not allow them to lie down. Sometimes, other patient's privacy curtain could be pulled in front of the large television, blocking their view. Patients who preferred the small arm-mounted television liked its closeness to patient's face, its relative quietness, its ease of adjustment and the fact that privacy curtains could not block it. However, the small set was more likely to get in the way of staff. Some patients said its screen was too small to see easily, and others said it sometimes got in their way, too. Personal audio devices such as pillow speakers or ear phones, and similar systems should be provided to control the noise from either small or large television sets. Besides, in order to prevent the potential problems related to television sharing, it is advisable to provide one television per patient (Carpman and Grant, 1993).

Another design element of rooms is a patient clock. Because patient's every day activities and lives are temporarily suspended during hospitalization, time seems to pass slowly for many patients. Most of them want to know the

time for keeping track of schedules for medical procedures, medications, visiting hours, television programs and the like. So that a clock need to be provided within the patient room. Every room should have its own clock that is visible from the bed. It should not be placed directly in the patient's line of sight. Readability of numbers is important. 12-hour clocks should be used rather than 24-hour clocks. Clocks that are non institutional looking should be selected (Carpman and Grant, 1993).

Art works may be used as an additional design elements in the patient rooms and they may provide an alternative entertaining way for inhabitants. Patients like to have interesting and pleasant things to look at while bedridden. Besides, watching television, looking out and enjoying their get-well cards, some patients like to have some art works in their rooms. Because artwork displayed in the patient room has the potential for being a source of pleasure and even for being somewhat therapeutic, it is important to select the artwork that patients like to look at. In order to provide information to be used by people selecting artwork for patient rooms, University of Michigan Medical Center conducted a patient and visitor participation project study which sought to discover patients' relative preferences for different types of artwork. Seventy one images were used. "Despite the diversity of images (subjects, settings and style) and of patients (illnesses, lengths of stay, ages, and education), preferences were quite consistent" stated Carpman and Grant (1993: 172) and added:

> Images they liked best had natural subjects or settings (animals, water ,valley, mountains, farmland) and were rendered in a representational style. They preferred paintings to photographs and liked texturally complex and somewhat organic images. Less favorably rated were pictures of people, urban scenes, still lives, building interiors, posters with words, spontaneous comments reinforced their choices.

According to interpretations, hospital patients wanted to look at images that helped them mentally escape to a more natural peaceful, beautiful setting. Most patients in this study avoided abstract art and commented that they did not want to look at a piece of art they could not understand. According to the same study, most patients viewed artwork as something that could make a positive difference in their hospital stay. In selecting artwork for patient rooms, the following guidelines should be considered: Art cart program should be provided in order to change artworks periodically. The location of artwork should permit patients to see it easily from the bed. Natural subjects and settings such as water scenes and landscapes should be selected. Photographs and paintings should be selected rather than posters with words. Images that are texturally complex may be selected. Dark, muted colors, portraits and urban scenes should be avoided. It is also possible to use mobiles as an artwork alternative for some patients rooms where room size is appropriate (Carpman and Grant, 1993).

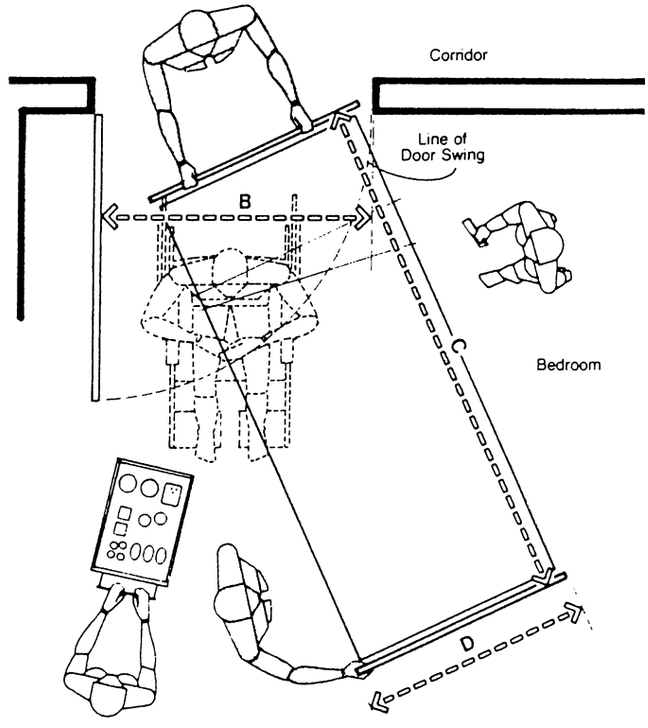
4.3. Accessible Patient Room Design

The term accessible is described by Davies and Beasley (1994) as elements of the physical setting that can be approached and used by people with physical and mental impairments. In a patient room design, accessibility is vital for two reasons: health and self-competence of patients. It is obvious that patient room design should give access to care activities. In order to facilitate health care activities that is vital for health there must be unobstructed area for movements of health care equipment. Accessibility in room is also important for a patient's feeling of independence. Since the self-competence is one the most critical factors in patients' recovery, healing and well-being, accessibility should be essentially provided in a patient room. It is an alternative way for patients to have a control over their environments

and function as independently as possible (James and Noakes, 1994; Davies and Beasley, 1994; Malkin, 1991; Cox and Groves, 1981).

In order to create an accessible patient room environment there are some considerations to be taken into account. First of all, standard dimensions of a stretcher, wheelchair, walkers, crutches and prosthetic devices should be considered and used as guideline in space arrangement. Hardware (door handles, cabinet pulls, and faucets) which are easy to manipulate and drawer glides and door closers that do not require too much efforts should be selected. Smooth transitions should be provided between different flooring materials. In addition, designers should carefully view the facility from the sight line of a person in a wheelchair. Window sills, nursing station counter height, glazed panels in doors should be designed to provide patients clear view from the wheelchair. Placements of an artwork, television, photographs, an storage cabinets, tackboards and shelves should be considered from this perspective. Most important all, anthropometric concerns should be considered very carefully for determining required clearances in a patient room (Malkin, 1991; Panero and Zelnik, 1979).

The room design is required to fulfill the needs of the person confined to a wheelchair. For this, there should be an area of 152 cm by 152 cm provided in front of a patient room door for maneuvering the wheelchair into an appropriate approach position, open the door and exit. Since hospital patient room doors are large enough to allow the passage of beds and other relatively wide equipment, the standard door widths are more than adequate for the wheelchair (see Figure 4.3.)



	cm
A	152
B	117-122
C	221
D	99

Figure 4.3. A Patient Room Door Clearance
(From Panero, J. and Zelnik, M. Human Dimension and Interior Spaces
New York: Watso Guptill Publications, 1979:246.)

Inside the room, there should be an adequate space around a patient bed for visitors' seating comfortably. This clearance should also be adequate to accommodate a standard medical wall unit on one side and a bedside stand on the other. Figure 4.4 and Figure 4.5 show the minimum and maximum clearances used in a patient room.

	cm
A	221
B	244
C	76 min.
D	99
E	252 min.
F	5-8
G	38
H	137 min.

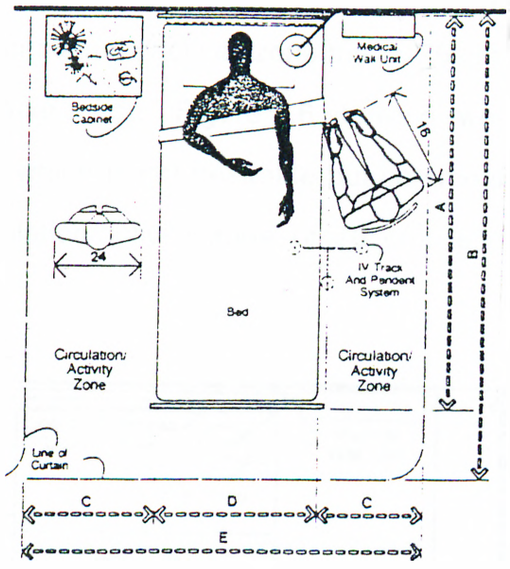


Figure 4.4. A Patient Bed Cubicle
(From Panero, J. and Zelnik, M. Human Dimension and Interior Spaces
New York: Watso Guptill Publications, 1979:243.)

	cm
A	221
B	244
C	76 min.
D	99
E	252 min.
F	5-8
G	38
H	137 min.

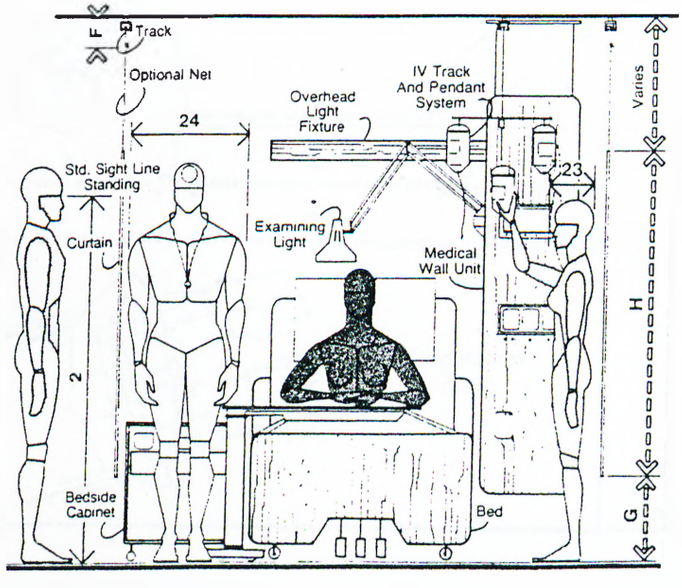
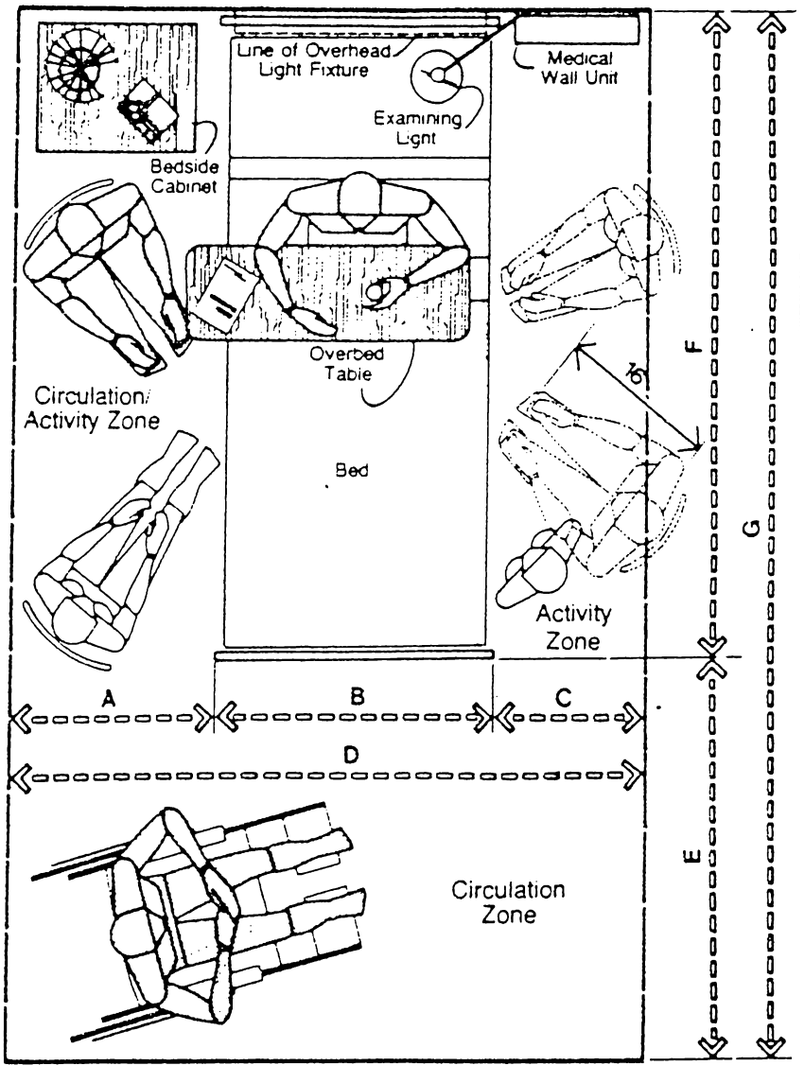


Figure 4.5. A Patient Bed Cubicle with Curtain
(From Panero, J. and Zelnik, M. Human Dimension and Interior Spaces
New York: Watso Guptill Publications, 1979:243.)

In shared rooms, the depth of a patient room is required to allow 229 cm for each bed position. An adequate circulation/activity zone that is 76 cm should be provided on both sides of a patient bed. Figure 4.6 shows a two-patient room having a depth of 4.57 cm, which is not desirable but commonly used in hospitals. An adequate circulation/activity zone of 76 cm, is only be provided on one side of the bed.

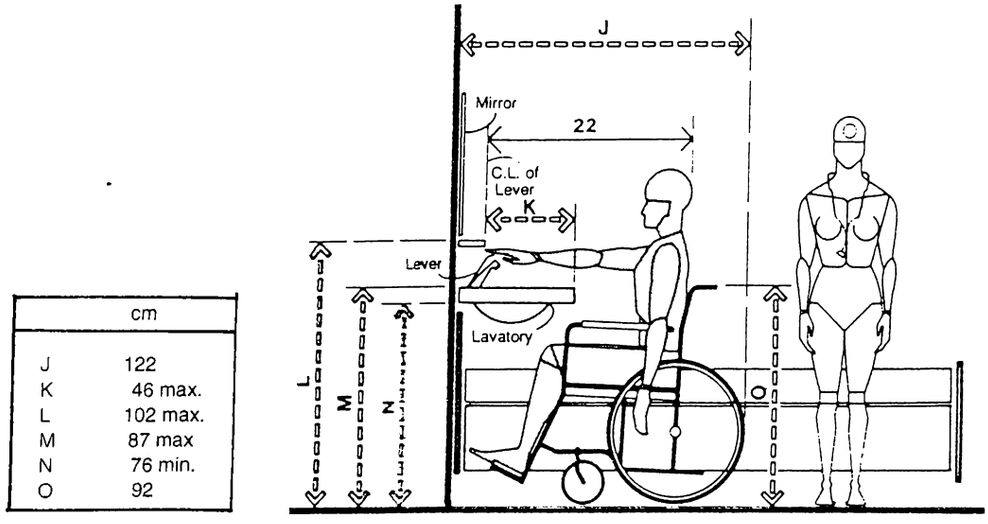


	cm
A	76 min.
B	99
C	53
D	229
E	137
F	221
G	356
H	137 min.

Figure 4.6. A Two-patient Room with a Circulation/Activity Zone provided on one side of the Patient Bed
(From Panero, J. and Zelnik, M. Human Dimension and Interior Spaces New York: Watso Guptill Publications, 1979: 244.)

For maneuvering the wheelchair in a patient room clearance of 137 cm by 137 cm area is adequate for a 360° turn.

In addition, an accessibility concerns should also be taken into account in designing a patient bathroom. An easy and safe access for a wheelchair or a walker and intravenous poles should be provided from a patient room to a bathroom. The bathroom door must open to outward to provide an access for emergency team and activities. The door swing should not cause any obstruction to a toilet, a sink and a shower. Figure 4.7. illustrates the relationship of a wheelchair user to wall-hung hospital lavatory. It is essential to provide a sufficient clearance in order to allow the wheelchair to slide partially under the bottom edge of the fixture.



	cm
J	122
K	46 max.
L	102 max.
M	87 max
N	76 min.
O	92

Figure 4.7. Bedroom /Bathroom Lavatory
(From Panero, J. and Zelnik, M. Human Dimension and Interior Spaces New York: Watso Guptill Publications, 1979:245.)

Placement and selection of various items such as grab bars, a sink, a toilet, a toilet paper dispenser, a flushing lever, a mirror, shelves for toiletries, an electric outlet, an emergency nurse call button and the others should be suitable for both a wheelchair user and an ambulatory patient. All water controls or knobs at sink, toilet and shower area should be easily reached by patients and controls that do not offer too much effort to manipulate should be selected.

4. 4. Color and Its Use in a Patient Room

Due to the fact that, color is one of the most powerful elements of the environments and also, influences human's physiological and emotional well-being, it is extremely important to learn how to use it constructively (Sun and Sun, 1992; Zagon, 1992). In a patient room, color of an environment should be suitable for the purpose of a medical treatment and not cause any disturbance to a patient.

A large body of research for measuring physiological responses to color have revealed that color of an environment has power to affect the human beings and ability to arouse physiological and psychological responses (Malkin, 1991; Zagon, 1992; Sun and Sun, 1992; Gappell, 1992). The fact is color affects emotions, thoughts, behaviors, stress levels and physiological functioning of human bodies (Weeks, 1996; Sun and Sun, 1992). In this sense, Birren stated that, "color has ability to serve man's physiological and psychological needs and to keep him on an even keel in times of stress" (Birren, 1982 as quoted in Venolia, 1988: 57). According to Alexander Schauss, the director of the American Institute for Biosocial Research, color can control many basic body functions, stress and emotional responses. It affects blood pressure, pulse and respiration rates, as well as brain activity

and biorhythms. For instance, it is claimed that the red color increases feelings of anxiety and stimulates the heartbeat, respiration rate and muscular activity where as blue color creates tranquilizing, calming and peaceful effects and reduces blood pressure, respiration rate, and muscular activity (Wikoff, 1996; Gappell, 1992; Sun and Sun, 1992; Weeks, 1996).

With respect to human responses to colors, it is true that there is a strong relationship between human physiological and psychological well-being and color. Although therapeutic and supportive environments can be created by convenient use of colors, it is also possible to achieve opposite effects. Therefore, use of color requires great responsibility and importance. Convenient use of color is more critical for hospitalized people who are more vulnerable to the stressors and negative conditions of environment.

In health care, color and color spectrum have long been used to promote healing in the various sections of the body. Although there is no scientific evidence of certain colors are proper for specific illnesses, it is suggested that colors are being used in the treatment of a variety of diseases. (Malkin, 1991). Zagon (1992) suggested that each color has particular qualities that are linked to the energy centers of the human body. Energy centers affect directly the human physiology and nervous system. Because of this relationship, it is suggested that the certain colors and the color spectrum are used to heal specific illnesses (Zagon, 1992). Gerber also (1988 as documented in Malkin 1991) claimed that the certain colors are associated with the energy centers of the human body and also with the emotions so that certain colors may be suitable for specific illnesses. On the other hand, a large body of research suggested that there is no scientific data available for using certain colors in the healing of specific illnesses (Malkin, 1991).

It is true that in health care environments color can have great contributions to the feelings and well-being of both patients and staff. A feeling of cheerfulness and optimism as well as freshness and cleanness can be created by using different colors (CIBSE, 1989). According to Zagon (1992), full spectrum as a group of colors needs to be used in all therapeutic environments. For instance, when pure and clear spectrum hues are present, a rainbow atmosphere is achieved that will enhance a patient's sense of optimism and hope. According to Malkin (1991), in health care environments color should be used to make enhance visual acuity in surgery or relax anxious patients. A designer's personal preference has little to do with the proper selection of color in non-residential spaces such as hospitals. The fact is patients cannot easily leave the care environment and it puts a great responsibility on designers to select a color that will not be a damage on the patients' feeling of well-being or worse negatively blood pressure, and their respiration or hormone activity.

Although there is not standard guidelines available for the selection of best color for patient care environments, investigations over the past 20 years provide enough knowledge for interior designers to find an appropriate strategy for health care interiors. First of all, using color requires a basic understanding of lighting. The distribution and the color characteristics of the light source are also important (Malkin, 1991). Secondly, color should never be seen in isolation due to it forms part of the total design. In other words, color should be considered in conjunction with the size and shape of an interior as well as the way it is to be lit. Choosing a color palette also depends on a use of space, type of task and the activity that is to be performed in it (CIBSE 1989; Gappell, 1992). In addition, needs of special patient population and other users' needs should be considered carefully. For instance, elderly patients may need more contrast and more saturated

colors. Understanding how the vision changes as the eye ages, will obviously be helpful for the best color selection. For new born babies continuos observation is very important for diagnosis of cyanosis and jaundice and using blue or yellow makes observing conditions difficult. The nature and severity of illness is another important factor. Suitability of color for men, women and children should be explored. Laws of perception that includes various concepts such as simultaneous contrast, successive contrast, after image, reflectance, advancing and receding colors and the like should be considered carefully for the best color selection. Symbolic associations with color, taboos, bias, and nationality concerns should also be taken into account (Malkin, 1991).

Despite a lack of substantive guidelines for the best selection of color in patient care facilities, color psychology can be used as the most useful reference for designers in order to develop color palettes that are reasonable, appropriate and not hazardous for patients. According to practical applications of color psychology in settings where creative activity and socialization desired, red and yellow should be used (Malkin, 1991; Weeks, 1996). Red stimulates the sympathetic nervous system, increases brain wave activity, and sends more blood to the muscles, accelerating heart rate, blood pressure, and respiration (Gappell, 1992; Zagon, 1992). Red may be appropriate in the depressed patient's environment. Green and blue will be appropriate for the areas that require more quiet and concentration and highly visual acuity. Blue triggers the nervous system, and is credited with a tranquilizing effect. Cool colors should be used in environments for agitated, hypertensive, or anxious individuals. Highly saturated colors should be avoided for those who afflicted with epilepsy and other neurological diseases. Bright colors should be chosen rather than pastels for the aged persons. In psychotic patients' rooms strongly contrasting figure-ground

patterns and extremely bright colors should be avoided. In selecting a best color for patients, the effects of color on perception should not be forgotten. Warm colors seem to advance and cool colors to recede. Under warm colored light, weights seem heavier, time is overestimated, objects seem larger, and rooms appear smaller. Under cool colors, weights seem lighter, time is underestimated, objects seem smaller, and room appear larger. Warm colors with high illumination encourage increased alertness and outward orientation; they are good where muscular effort or action are required, such as a physical therapy gym. Cool colors and low illuminations encourage less distraction and more opportunity to concentrate on difficult tasks; an inward orientation is fostered. Noise induces increased sensitivity to cool colors, probably because the calming effects of these colors compensates for increased aural stimulation. People become less sensitive to warm colors under noise, because they offer additional stimulation rather than less. In patient rooms, patterns should always be accomplished by a neutral wall for providing relief (Malkin, 1991; Gappell, 1992).

"The absence of color in patient rooms is terrifying "said Malkin (1991:84) and suggested colors that are flattering to skin tones should be used. According to Palmer (1996), there should be selective use of pastels and distinctive coordination in each patient's room rather than the monotonous repetition of the same color throughout the unit. The fact is monotonous environments cause sensory deprivation and can damage healing. White walls that are commonly preferred in hospital rooms should be avoided because they cause considerable glare, which in turn causes the pupil to constrict. White walls have also a clinical appearance that is unfamiliar and strange to most patients. The combination of white walls, white ceiling, and white floor may create strange perceptual conditions that can be very upsetting to patients who are trying to stabilize their balance or orient

themselves (Malkin 1991). In patient's bathrooms, a light tint of rose or peach in a shade that is flattering to skin tones should be used, especially if fluorescent lighting is used around the mirror. A feeling of self-estimate is important for patient's morale. If lighting is poor and colors are unflattering to skin tones, patients may be shocked at their appearance. Selecting colors having medium to high reflectance for the walls and ceilings will lead to a sensation of lightness. Since the color rendering properties of the light sources are critical in areas where patients are diagnosed or tested, use of large areas of dominant colors which can distort the color appearance of the visual task should be avoided. A colorful design including a few small areas of saturated colors in conjunction with light colors for the main surfaces can be appropriate. In general selecting colors having medium to high reflectance for the walls and ceilings will lead to a sensation of lightness. Recommended color finishes in critical clinical areas are given in Table 4. 4.

Table 4. 4. Recommended Reflectance for Critical Clinical Areas

Clinical area	Ceiling	Walls	Floors
	Recommended reflectance	Recommended reflectance	Recommended reflectance
Operating departments, neonatal and delivery department, intensive care unit, drug preparation, pharmacy, and teeth matching dentistry	0.7-0.8 E C	0.5-0.6 B C C	0.3 A B B

A Bed head
B Circulation space
C Nurse's station or Staff base
E Ward corridor (partly open)

Source: CIBSE. Lighting guide: Hospitals and Health Care Buildings London: CIBSE, 1989: 3.

4. 5. Light and its Use in a Patient Room

Lighting as one of the environmental factors like sound, color, form, and size affects the senses and also stress levels of individuals. It is a highly significant environmental stressor that influences everyone whether it is natural or artificial (Malkin, 1991; Carpman and Grant, 1993).

The fact is that light is vital for the biological and physiological health of human beings. A large number of studies have shown that light affects the human body in ways other than producing vision. The effects identified so far include body rhythms. There are currently 3000 references on light's affect on human chronobiology (Steven and Zilber, 1993) Studies also showed that wellness and recovery are greatly influenced by the patient's physical environment which often help to contribute his or her mental outlook. There can be psychological benefits of lighting for patients as well. Due to that lighting is widely acknowledged as one of the key elements in designing environments, it makes sense to assume that creating an efficient design for providing natural and artificial lighting is an valuable alternative way to be considered in health care and a design of patient room (Schwartz, 1993).

If adequate lighting is sufficiently used, it can help patients physiologically and psychologically in their wellness and recovery process (Schwartz, 1993). In a patient room, lighting can provide not only comfort and ambiance, but it can also make sick patients look healthy or healthy ones look sick (Carpman and Grant, 1993). Therefore, lighting and related design considerations in a patient room must be considered very carefully and be best handled in a collaborative effort between architects, interior designers, electrical engineers and perhaps a lighting design consultant (Malkin, 1991).

4. 5.1. Natural Lighting

In a hospital patient room daylight is an important factor for both health givers and patients. Special attention should be given to the contribution of daylight, in the design of electric lighting (CIBSE, 1989).

Carpman and Grant (1993) suggest that, in hospitals and other health-care facilities the best lighting design solution should be to maximize the use of natural light in the architectural design. According to CIBSE (1989), in some part of buildings natural light (daylight) provides sufficient and suitable illumination for normal visual tasks throughout the middle part of the day. Full use of daylight, on the other hand, is not possible. Artificial illumination is also required and used even during the daytime. The fact is daylight sometimes can be limited by the surrounding building or the extent of daylight penetration and its distribution is necessarily restricted in order to avoid glare from the windows in the less brightly lit parts. Buildings may have sealed arrangements and consequently, there will not be adequate daylight for natural lighting. However, clerestory window arrangements can be used as an alternative way to provide adequate daylight and also create homogeneous daylit spaces (CIBSE, 1989). Atria, and skylights with proper diffusers may also provide adequate daylight (Gappell, 1992).

Generally, the major lighting source in a patient room located at the perimeter of the building is natural light during the day time. Windows are both passing adequate daylight and providing patients the view of the outside environment. The fact is windows are important for visual, thermal, and psychological comfort. In addition to providing natural light, windows give a touch of nature associated with relaxation that calms patient and encourage faster healing (Gappell, 1992). Windows should be designed in

order to provide patients outside view from the bed (CIBSE, 1989). The sill height should be low enough for a seated person and a wheelchair user as well (Goldsmith, 1976). For having an equal access to outside light and view the windows should be arranged properly as well. Sometimes ventilation minimizes some of the problems that are inherent when one bed is favored over another. There should also be a security window that is accessible to street level. In addition, windows should be fixed with operable sliders and vents (Deasy and Lasswell, 1985).

Exterior windows can be a source of unwanted glare. Outdoor illuminance values, that are fundamentally different from interior values, can produce significant sources of glare that require the use of blinds or other means of controls for reducing the luminance through the windows or skylights. Special attention should be given to provide daylight controls at the windows which may be arranged with color and design for visual relief as providing protection and control. In order to avoid unnecessary brightness (glare), windows should be on one side or behind and not be straight in front of patients. Besides, control devices at windows must be operable by the patient in order to regulate the light from windows which may be in front of them. Providing control buttons for patients to operate motor-driven draperies or some other means of control may be a solution. Additionally, there can be light controls which may be a part of architectural design. The buildings may be designed considering the geographical distribution of daylight and required precautions related to need of control can be taken accordingly. Hence, the building may not be required to have any additional light control devices (CIBSE, 1989).

During the day time, daylight falls across the width and length of the patient rooms. Illumination varies ranging from 50 lux on a dull day to 30 000 lux

near or under the windows on a bright day. If the window is located adjacent to the back of beds, the daylight may fall across the width or length of the room. The amount of daylight depends to some extent upon any external obstruction and consideration may need to be given to roof windows or additional electric lighting. When the natural light is not sufficient to provide the illuminances recommended in Table 4.5.1. supplementary electric lighting should be used. Where rooms are open to corridors or separated from them by glazed partitions, the lighting design for corridor should take into account the effect of natural light (CIBSE, 1989).

Table 4.5.1. Service Illuminances Recommended for Wards

Location and time†	Service illuminance‡	Position of measurement (horizontal plane)	Type of control
Morning and evening†	30–50	Bed-head	Normal
Night (adult)	0.1	»	Normal
Night (children)	1	»	Normal
Night (mentally ill)	1–5	»	Normal or Special (restricted access)
Night (watch lighting)	5–10	»	Normal
Reading light	150	»	Normal
Circulation space§ in bedded areas (B):			
Day¶	Not less than 100	Floor	Normal
Morning and evening†	100	»	Normal
Night	3–5	»	Normal
Nurse's station or Staff base (C):			
Day	300	Desk	Normal or Selective
Morning and evening†	300	»	Normal or Selective
Night	30–200 (well shielded)	»	Selective or Variable
Ward corridors, screened from bed-bays (D):			
Day	150	Floor	Selective or Variable
Morning and evening†	150	»	Selective or Variable
Night	5–10	»	Normal
Ward corridors, partly open to bed-bays (E):			
Day¶#	200	Floor	Selective or Variable
Morning and evening†	150	Floor	Selective or Variable
Night	3–5	Floor	Normal

Table 4.5.1. (cont'd)

Notes:

The letters (A), (B) etc., refer to locations marked on Figure 4.8

† 'Morning' is the period after patients are awakened until sufficient daylight is available. 'Evening' is the period after daylight has become insufficient until the night lighting conditions prevail.

‡ Where two figures are given, these are minimum and maximum recommendations.

§ The central space between the foot ends of the beds.

¶ The main contribution will be daylight but electric lighting may be needed as a supplement.

The illuminance value of 200 lux in ward corridors partly open to bed-bays is to take account of daylighting entering from the windows opposite and provide a balance to the daylight in the circulation space.

Source: CIBSE, Lighting Guide Hospitals and Health-Care Buildings. London: Collins and Wilson, 1989:17.

Another consideration of natural lighting is the illumination of fringe zones of the daylight areas. These areas can be illuminated by permanent supplementary electric lighting which is left in operation during daytime. Such lighting should be designed to integrate visually with natural lighting while supplementing the horizontal illuminance to maintain the recommended value and preserve the daylit character within the space, so extending the use of available daylight to a greater area (CIBSE, 1989).

The fact is the interaction of natural and electric light is not simple. There are some considerations to be remembered. The flow of natural light across a room from a window is fundamentally different from the electric light produced by luminaires, in that the surfaces facing towards the window are more brightly lit than those facing away from the window. Furthermore, the view of a distant scene or daytime sky seen through the window has a much higher illuminance than a luminaire. The brightness of the window makes the electric light appear less bright, because of the adaptation of the human eye to the outdoor scene. Electric lighting installation in an area close to good day lighting may be required to produce more light to give an acceptable overall balance of brightness than that for an area fully screened from daylight and artificially lit. Additionally, an area in which there is no

daylight and electric light is needed at all times may require lighting to a higher level if there is an adjacent area in which adequate day lighting is visible (CIBSE, 1989).

Direct light and heat from the sun and sky entering a room through a window are usually at levels far in excess of those generated by the electric lighting. The resulted problems may be taken into account by careful window design in the original construction or by using external structural elements such as balconies or caponies to screen the window from the direct sunlight. Alternatively, in the case of existing buildings, blinds can be used to provide shading. Tinted glasses may be used to control sky glare and solar heat gain in both new and existing buildings. However, it is important to note that solar control glasses are not normally suitable for controlling glare caused by a direct view of the sun. Controlling glare may be done by the use of mechanical shading either by the building structure or by a blind or some other shading device (CIBSE, 1989). Additionally, special attention should be given to the selection of solar control glasses although none of those currently available have a significant effect on color rendering of patient's skin. Neutral tints should be selected for clinical or laboratory areas where critical examination of the patient's skin color is to be performed. The color of the wall surfaces and the type of light source will generally have a greater influence (CIBSE, 1989).

4.5.2. Artificial Lighting

Schwartz (1993) suggested "Good lighting is good lighting, no matter what the environment is" and added that "in hospital settings and other health care facilities, all efforts have to be done to ensure comfort aspects, such as glare control, good-quality color rendition, flexible dimming and adequate-

intensity illumination without overlighting" (32). The fact is developing an atmosphere that addresses the comfort needs of patients and task needs of health care staff and housekeeping personnel is the key to hospital lighting design (Schwartz, 1993). According to Smith (1992) and Carpman and Grant (1993), and also CIBSE (1989), the lighting and illumination provided in a patient room should serve various facilities of the medical and nursing attendants as well as fulfill the needs of the patients and visitors. Figure 4.8. shows the typical lighting design of a care unit in order to serve various facilities of both medical staff and patients at the same time (CIBSE, 1989).

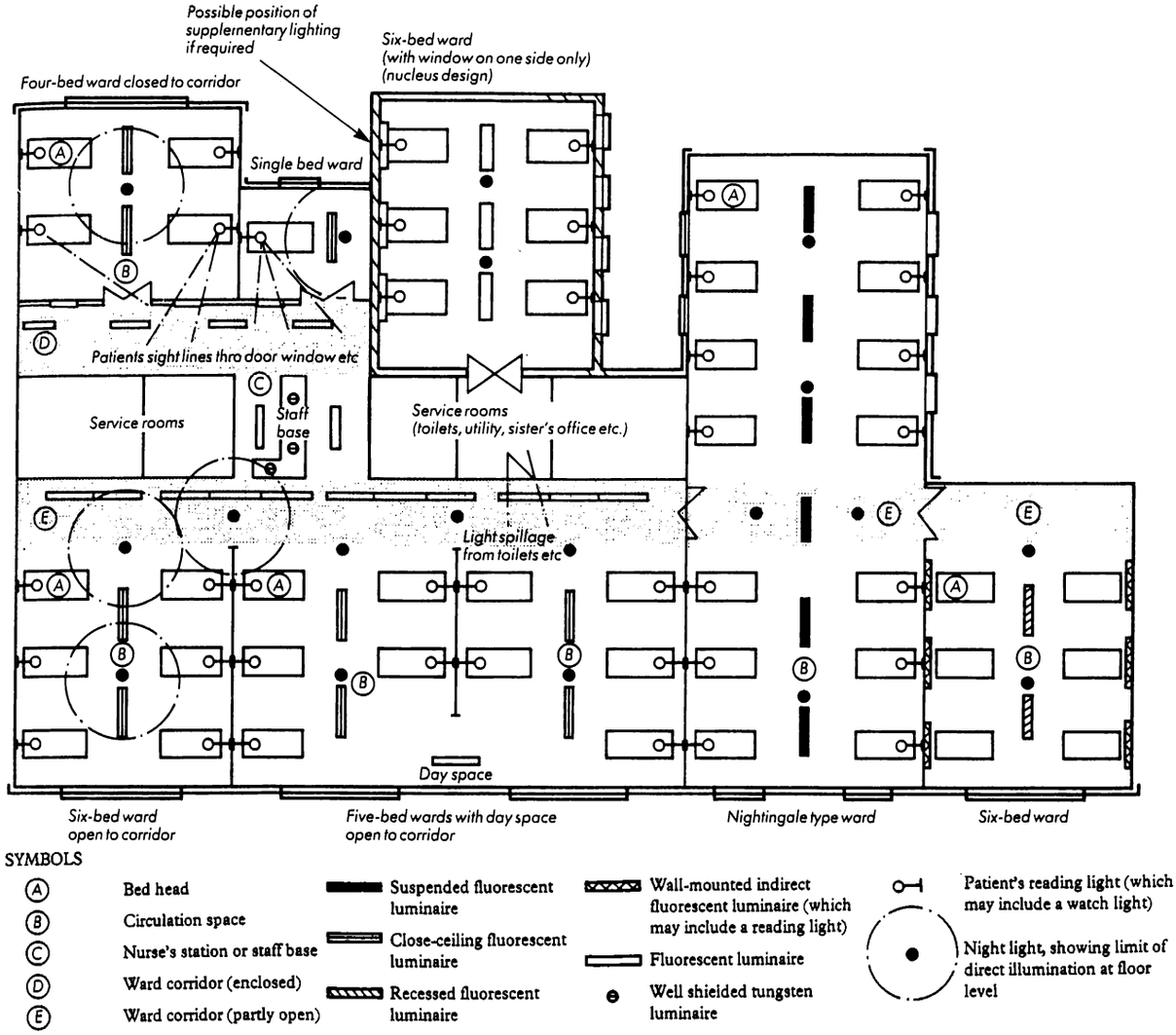


Figure 4.8. Typical Lighting Design for a Care Unit
(From: CIBSE, Lighting Guide Hospitals and Health-Care Buildings. London: Collins and Wilson, 1989:15.)

In order to facilitate all these tasks, standard lighting requirement of a patient room includes an ambient lighting system for general illumination, an examination lighting, a watch lighting, an individual's reading light, a night lighting (Schwartz, 1993). In addition, various lighting methods and type of luminaires can be used according to ceiling heights and the activity performed. Most important all, light sources which have color characteristic as close possible as to natural daylight should be selected for patient rooms. Due to the fact that in patient rooms rendering the skin as realistically as possible is vital for recovery of patients and diagnosis of illnesses, providing a full-spectrum lighting sources is an obvious requirement of a patient room lighting design (CIBSE, 1989).

Illuminating Engineering Society Health Care Facilities Committee ((IESNA),1985) suggested that problems of a patient room lighting is the necessity of providing various lighting needs and illuminance levels at different times required by various people. In addition, providing lighting requirements as simple and economically as possible is another goal to be achieved. Since the major purpose of the hospital is to restore the patient to health, lighting for medical and nursing services, and critical examination is the most essential criteria in a patient room lighting for a successful care.

4.5.2.1. Lighting for Medical and Nursing Services

Medical and nursing staff's needs related to lighting generally involve task accomplishment in a patient room. Various nursing activities require specific lighting features and illuminance levels (IESNA, 1985).

General room lighting, as a major light source of a patient room is necessarily important for observation of patients and additional medical and

nursing services. It should be provided with multiple switching and dimming in a patient room. Illumination levels should be adjustable according to the time of day, amount of sunshine received from the windows, the task being attempted, and the patient's vision. The general room lighting should provide the recommended illuminance indicated in Table 4.5.1. It is obvious that the color characteristic of general room lighting should be as close as possible to natural daylight (Carpman and Grant, 1993). Controls related to lighting should be easily reached by the medical staff. The nurses should never have to search for light to read charts and thermometers. The general lighting must be adequate for the care of the patients by the nursing staff whose duties include observation of the patients, marking charts and reading thermometers. For these tasks to be performed efficiently, the illuminance on patients faces should be between 30 and 50 lux and the illuminance in the central space between the bed foot rails should be not less than 100 lux. These levels will also be sufficient for general activities of ambulant and recumbent patients without causing disturbance to other patients in the room who may wish to sleep. When there is a need for more lighting in room, the patient's reading light may be used additionally. To prevent excessive spottiness of general lighting, the installation should provide a lighting level ratio of not more than one to five on a horizontal plane 760 mm above the floor within a radial distance of 2.4 m from the maximum level on that plane (CIBSE, 1989; IESNA, 1985).

Various methods may be applied for general lighting purpose. Centrally mounted luminaires such as suspended luminaires, close-ceiling luminaires, recessed or semi-recessed luminaires or wall-mounted luminaires can be used. However, wall-mounted luminaires will be more appropriate for single patient rooms where the lighting requirements include only one patient. If fluorescent lamps are used for the general lighting of a patient room, that

should be only the improved color types. To minimize the probability of replacing burned-out lamps with inappropriate types such as those emitting light high in the blue region, only the recommended types should be specified and stocked for use throughout the whole hospital (CIBSE, 1989).

For patients' examination, an additional local lighting is commonly used in patient rooms. The examination activity requires the patient's body or a part of the body to be well illuminated by a light source which also should minimize shadows. A large diffused field of light that illuminates the whole bed should be provided. Shadows and unnatural tones caused by lighting should obviously be avoided. Examination lighting is required to have color characteristics as close as possible to a natural daylight. The function of examination light and reading light should not be combined in one luminaire (CIBSE, 1989).

There may be various ways to provide examination lighting. A mobile examination lamp may be used for this activity. Detachable wall or locker mounted luminaires should be avoided since they cause both electrical and thermal hazards (CIBSE, 1989). In addition, they often do not give adequate illumination for examining the patient (De Chiara and Callender, 1990).

Watch lighting is the other essential requirement of a patient room. Generally, the purpose of observation lighting is to provide continuous watching of a patient after the general lighting has been switched off, without disturbing particularly reading activity. For observation of patients local low level illuminance of a good color quality which is proper for the diagnosis of the patient's appearance should be provided. There should be lighting at each bed so that the nurse may frequently observe the patient and equipment, such as drainage tubes and containers, during the night with

minimum disturbance to patients. Observation light should be switched at the door, and may also be controlled by a dimmer. When observation lighting must be left on operation all night, or when higher illuminances are needed, temporary screening for other patients may be necessary. Adequate illuminance is 5-10 lux at the bed head provides the recommended night lighting level. Single compact source of fluorescent lamps or incandescent lamps located either in the bed-head unit or in luminaire can be used (CIBSE, 1989)

4.5.2.2. Lighting for Patients

Generally, patients' and visitors' needs related to room lighting concerns include ambiance and non-medical functions. Patients generally need low lighting for watching television or talking quietly; task lighting over the bed for reading and writing; medium-level lighting for a conversation with roommates; and a dim night light for late visits to the bathroom. Since their lighting needs are varied, it is better to design a flexible system that offers several light sources and illuminance levels each adjustable by multiple switching or a dimmer. Equal importance should be given to control systems that should be located at patient's bed side. (Carpman and Grant, 1993). They should be designed in a way to provide ease to patients in a room environment. The illumination in shared rooms should not be an obstacle to one roommate while remaining adequate use for the other. It is obvious that factors which produce discomfort through glare or harm from overexposure of the patient's retina should be avoided as well (CIBSE, 1989).

For patients' reading and writing activities, there should be special lighting arrangement provided in rooms. The reading light is required to provide light at normal reading position, assumed to be 1140 mm above the floor.

Visual fixing heights are 160 cm for adjustable arm types and a minimum 280 cm for fixed arm types. It is required to give 150 lux directly on the pillow. The control should be easily reached by patient. The luminance of the reading lamp and any surface illuminated by it should be less than 300 cd/m2. (CIBSE, 1989; IESNA, 1985). Reading light should be located above or close to the patient's bed. Lighting fixtures should be adjustable to move light upward and downward (Carpman and Grant, 1993). Generally, fixed or adjustable arm types are available and commonly used in patient rooms. On the other hand, when the reading light is adjustable to suit the patient's position in bed, its movement should be limited to avoid causing glare to others. Wall mounted incandescent, or fluorescent, or ceiling mounted reading lights can be used in for the reading activity. In rooms where children and mentally patients stay, either ceiling mounted reading lights should be used or high-level wall units should be selected in order to prevent the reach of inhabitants. Ceiling mounted reading lights in some cases provides higher degree of safety and leaves the space above the bed-head unobstructed. Wall mounted luminaires should be positioned so as to permit easy adjustment by the patients. Lighting fixtures are required to have limited movement capacity in order to prevent annoyance to other patients (CIBSE, 1989).

In addition, reading light can also be used for watching and talking activities. Desirable low and medium-level illuminance may be created, if reading light is controlled by a dimmer (CIBSE, 1989).

For safe movements of patients and also for late visits to bathroom night light is essentially provided for patients. There should be enough light to illuminate the path between patient's bed and bathroom. In addition, it should not cause any disturbance to sleeping patients (Carpman and Grant, 1993;

CIBSE, 1989). The illuminance on the bed head should not exceed 0.1 lux for adult patients. For circulation area, it should be between 3 and 5 lux. Although visual acuity is low at this level, it is possible to move safely. The luminance of any luminaire left on during the night should not exceed 30 cd/m2 as seen by patients from their beds. Wall-bracket combination lighting units for patients' use frequently incorporate a night light with switch at the bed side. A night light of this arrangement is desirable for the occasional use by the patient or nurse. However, when it is left on continuous operation, the luminance produced in the surrounding field of darkness is sometimes a source of annoyance to patients wishing to sleep. Special attention should be given to switching the night light out in corridor or near room door, rather than at bed side (Chiara and Callender, 1990). For continuous use, the night light is required to be a low brightness luminaire with louvered or refractive cover, flush wall type. This method provides enough light to patients in order to see objects in the room or for self-care, as well as gives higher illuminance on the floor. Night lighting may be controlled by a dimming switch (CIBSE, 1989). According to Grant and Carpman, (1993) a small night light and illuminated switch should also be provided in a patient bathroom.

Various types of luminaire, such as fixed wall units or wall mounted lamps, mechanically adjustable lamps that is to be attached to a corner of beds and floor stands can be used for night lighting purpose. Each luminaire has different qualities indeed. For instance, fixed wall-mounted lamps provide a small lit area when the bed is adjusted for reading in a prone position. In addition, when the bed is moved out from the wall or elevated, the lit area is remained in back of a patient head. Wall-mounted lamps with extension arms partially solve such problems, but they are commonly used as a handhold by patients to pull themselves. Floor stands and table lamps are

more suitable for a single patient room where lighting concerns cover only one person (CIBSE, 1989).

4.5.2.3. Lighting Control Systems

In a patient room, the success of electric lighting depends to some extent upon fully operable control systems such as switching and dimming. Such systems generally aim to guarantee that the lighting system works only when it is needed or required. Because there can be some problems between nursing and clinical procedures and controlling systems such as switching signals may influence sensitive equipment, patient monitoring, nurse call and fire alarm systems, all control systems should be considered and selected carefully with electric lighting design before the application of lighting. Standard room switch controls except where dimming required can be used (CIBSE, 1989).

For controlling of luminaires there are different types of switching methods such as manual switching, manual selective, photocell switching, time switch and occupancy detectors. In manual switching system special attention should be given to zoning particularly for deep plan arrangements. Labeling is also important for the correct use of zoned lighting. Manual selective switching can be applied to one or more luminaires in an installation or to one or more lamps in a multi-lamp luminaire. There can be either single or two-way switching for control. Local switching is suitable for areas where local lighting has been used. For areas that are infrequently occupied and for short periods like storerooms, time-lapse switches will be more appropriate. Photocell switching can be used in two ways:

(a) To operate a relay when the illuminance reaches predetermined level or via a control circuit to control zones or reduce the number of lamps energized as daylight increases.

(b) to dim luminaires, via a control circuit, as the daylight illuminance increases. Photocell switches can be located in the illuminated space provided that they are shielded from the light emitted by the luminaire being controlled (CIBSE, 1989: 65-66)

Occupancy detectors are devices which are sensitive to infra-red radiation, sound or movement. They can be used for controlling of luminaires. However they are expensive and have some limitations related to use in hospital environments (CIBSE, 1989).

Another way of controlling luminaires is dimming which is required if there is a need to diminish the illuminance in patient rooms. Tungsten filament lamps and some type of discharge lamps such as tubular fluorescent lamps can be dimmed. Energy consumed by lamp is reduced by dimming and color properties of light may be changed (CIBSE, 1989).

Dimmers can be controlled either manually or automatically according to daylight received. There are different types of controls used for dimmers: some pre-set and others down to zero. They can be operated as on/off switches or be arranged for two-way operation. Flexible and reverberant bases where dimming ballasts are mounted may cause vibration and sometimes undesired audible humming can be produced so that firm mounting and suitable sound insulation are necessarily required (CIBSE, 1989).

With respect to create fully operable dimming system, it is important to use lamps of same rating with each dimmer in order to create regular starting and uniformity. Equally importance should be given to ensuring that there is

no other equipment connected to the same supply which could cause transient surges since these may trigger the thyristor and cause the lamps to flash (CIBSE, 1989).

4.6. Heating, Ventilation and Air Conditioning (HVAC) Systems

Although people have different thermal needs depending on environmental conditions, heat, cold, temperature and humidity strongly affect how they feel in an environment both physically and emotionally. Thermal conditions are very important especially for human health and unsuitable conditions may cause headaches, dizziness, fatigue, respiratory problems, impaired vision, hearing, and brain function and, stress that have negative impacts on recovery, well-being and healing. Temperature and humidity are even known to affect wound healing. Unsuitable thermal conditions can be hazardous and even fatal to the elderly, the very young, and others who are unable to regulate their internal temperature (Venolia, 1988).

In health care settings an air conditioning is generally a matter of economics and climate (Chiara and Callender, 1990). However, heating and ventilation are important for comfort of patients and also very complex issues that require careful considerations (Malkin, 1991).

Depending upon different departments and the population served, patients' needs related to heating, ventilation and air conditioning are changeable. Patients under anesthesia, those with cardiac conditions, spinal cord injuries, burns, infants and the elderly are more vulnerable to thermal conditions (Malkin, 1991). In patient rooms special attention should be given to the elimination of drafts by making sure doors and windows of units close tightly and by the use of thermopane insulated glass.

In contemporary buildings, including hospitals sealed building arrangements sometimes cause total dependence on mechanical systems for heating, ventilation and air conditioning. Under such circumstances windows are almost non operable. A research done by the National Institute for Occupational Safety and Health (Olds and Daniel 1984 as documented in Malkin, 1991) revealed that there is strong correlation between poor ventilation and a number of illnesses including headaches, fatigue, sinus congestion, eye irritation, chest tightness, nausea, dizziness and dermatitis which simply have negative effects on patients' healing process both physically and psychologically. Many hospital-originated diseases are related to this condition. These problems are common in large buildings with non operable windows and ventilation systems that filter only about 85 percent of the air (Olds and Daniel, 1987). A variety of pollutants such as smoke, hair spray, perfume, body odors and airborne bacteria resulting from off-gassing of synthetic building materials are recirculated and inhaled by the building's users. With respect to air quality Malkin (1991) suggests fresh air is one of the most obvious requirements that must be provided in healing environments. Therefore, there must be solarium, or roof garden designed for patients. Noxious off-gassing from synthetic materials, including certain types of paint, odiferous cleaning agents in patient rooms should be avoided as well. For thermal comfort, which is an essential component of healing environments and have effects on patient's well-being, room temperature, humidity, and air circulation should be controllable in order to create suitable thermal conditions for patients.

According to Smith (1992) and Grant and Carpman, (1993) mechanical ventilation systems which is capable of providing approximately 10 air changes per hour should be selected. Heating systems that is capable of maintaining a temperature of 24° C. Also cooling system that is capable of

providing a temperature of 26° C are proper for patient rooms. Additionally, systems that are designed to avoid drafty areas should be selected. Most important all, in medical suites there must be central HVAC system even at minimum construction cost, generous fresh air supply and individual room system must be provided, applied for all patient rooms and bathrooms throughout the care unit.

In single room units there is no problem of cross-contamination of air from one room to another. Generally, central HVAC systems do create problems if recirculation is desired. Hospital administrators and designers, on the other hand, suggest that central recirculation should be permitted (Chiara and Callender, 1990).

4. 7. Materials

Proper selection of materials can prevent patients and visitors from falling risks and glare problems in a patient room. Therefore, resilient, nonglare and nonslip (even when wet) materials should be selected for a room flooring (Deasy and Lasswell, 1985; Malkin, 1991; Carpman and Grant, 1993).

Although there is not standard guidelines to prefer one type of flooring material over another carpeting is inappropriate for a patient room flooring even it reduces glare and has safety advantages (Chiara and Callender, 1990). Ceramic tile is commonly used in many hospital patient rooms and wet areas. Materials such as cushion sheet vinyl and vinyl composition tile (VCT) that has to be waxed and buffed are also appropriate depending on different needs. It is vital to aware of potential safety problems, such as loose seams. In places where sanitation concerns are important, sheet vinyl

which has fewer seams than vinyl composition tile will be more convenient (Smith, 1992).

If there is a special need to use carpeting in a patient room or care unit nylon, wool, polypropylene carpets with a pile height of less than ½ inch for ease of wheelchair manipulation should be selected. Uneven carpet levels should be avoided. Solution dyed nylon which resists caustics and bleaching, antimicrobical, flourochemical treatments that resists stain- the most common reason for carpet replacement- should be selected as well (Grant and Carpman, 1993; Smith, 1992).

Walls can be covered by vinyl wood veneer or any other commercial vinyl wall coverings. Gypsum board substrate non-textured, gypsum board textured or painted can also be used for wall coverings. Wood paneling, grass cloth and woven fabrics should be used particularly for consultation and waiting rooms. Fire-resistant materials should be preferred for safety reasons (Smith, 1992).

For ceilings, suspended acoustic tile and plastic coated should be used, if extreme sanitation is important (Smith 1992). The fact that use of a suspended acoustical system is more valuable for access to mechanical work rather than its acoustical properties (Chiara and Callender, 1990).

Doors should have minimum 1-3/4" solid core and w/gaskets should be used for sound privacy. Frames should have 16 gauge steel or extra-sturdy wood jambs and frames. Hardware must be lockable and suitable for a patient use. Architectural hardware is important for health care facility design. It can help or impede the use by persons with physical impairments and affects their feelings of competence. Therefore, hardware that can be operated with

one hand and does not require excessive strength should be provided. Door hinger or operating devices and door closers that are easily to manipulate should be selected as well (Grant and Carpman, 1993) In addition, Standard tubular latch set or cylindrical lock set is appropriate for a patient room doors. Security locks are required for records storage and medicine storage (Smith, 1992).

5. DESIGN GUIDELINES FOR SUCCESSFUL ACUTE-CARE PATIENT ROOMS

Guidelines for the design of successful acute-care patient rooms can be classified into eight categories. Necessary requirements related to the privacy concerns, patients' control over the room, the size and the layout, the furnishing, the use of color and natural and artificial lighting, and the heating, ventilation, and air conditioning systems will be examined under the following titles.

5.1. Acoustical Privacy Requirements

1. Locate the quiet activity areas near the patient rooms in the care unit.
2. Provide a sound-attenuating material between the patient rooms.
3. Provide technical equipment that do not cause any persistent vibratory sound.
4. Provide visitor lounges for the families' private conversations.
5. Avoid slamming doors and windows, clanking latches, loudspeaker systems for the general communication among the medical staff all over the unit.
6. Consider using door sets that have minimum 1-¾ or 5,5 cm solid core and w/gaskets.
7. Consider using the interior surfaces and the furnishings that do not reflect or amplify sound waves.

8. Select soft, porous materials, sound-absorbent, upholstery drapes, fabric-wrapped acoustic panels and ceiling tiles for the design of a patient room.

9. Avoid use of non-absorbent materials such as plasters, glass concrete, and sheet plastic all over the room.

10. Consider selecting of fire-retartant, easily washable wall fabrics to muffle sounds and protect walls from wheelchair abrasion.

5.2. Visual Privacy Requirements

1. Provide a single room for the most of the patients.

2. In shared rooms, provide a motorized privacy curtain around the each bed so that the patients can control the social contact and the view of the others in adjacent beds.

3. Locate the bathroom on the hallway wall and select self-closing door sets which blocks the occasional observations of the passersby.

4. Make sure that the room door is hinged on side toward the beds, so that the ajar serves as a screen to the patients.

5. Locate the room door in the line of the foot of the bed rather than the head of the bed.

6. Provide a motorized curtain for the interior and the exterior windows so that the patient can control his or her privacy.

5.3. Control over the Room

1. Make sure that all facilities are provided for each bed in shared patient rooms.

2. Provide bed controls, nurse call button, light and television controls that are easy to understand and manipulate while lying down or sitting up.

3. Provide the required means of controls for patients in order to function as dependendly as possible.

4. Provide opening and closing hardware (handles, cabinet pulls and faucets) that are easily reached and manipulated by the patients with hand impairments and wheelchair users.

5.4. Size and Layout Requirements

1. Provide a clear path between the room door and the patient beds for getting a direct access in an emergency activity.

2. Make sure that the unobstructed circulation space around the beds is provided for health care team and technical equipment.

3. Make sure that the room door can be fully opened and it is wide enough to provide an access for medical equipment.

4. Provide an open aisle between the patient beds so that the visitors can place their seats on either side of the patient's bed.

5. Locate the beds in order to provide an access to a headwall unit from the both sides of the beds.

6. Locate the beds so that the each patient can have equal access to the outside view, light and ventilation.

7. Provide an adequate circulation space for a stretcher, a wheelchair, and other prosthetic devices.

8. Provide smooth transitions between different flooring materials for the wheelchair and the stretcher accessibility.

9. Provide a clear path from a bedroom to a bathroom door so that wheelchair users can get an access to a bathroom.

10. Select non-slip flooring materials (even when wet) for the patient bathroom.

11. Make sure that an adequate circulation space in the shower, toilet, and sink area in the bathroom for the wheelchair maneuvering and the nurse assisting.

12. Provide an adequate space to place the portable shower seat in the shower area.

13. Provide space for each room element such as, a wardrobe, a bedside stand, an overbed table, a tackboard, a comfortable patient chair and a headwall unit.

14. Provide a comfortable multi-position recliner, a sleep chair or a cot in a single patient room for overnight visitors.

15. Locate all controlling devices (window blinds, lighting controls, water faucets, shower heads, electric outlets, and the like) and the nurse call button in the patient bedroom and the bathroom sufficiently so that both ambulatory patients and wheelchair users can reach and manipulate them easily.

16. Make sure that the height of the sink and the toilet are convenient for wheelchair users.

17. Position the toilet items such as, a flushing lever and a mirror, a shelf, a towel hook, and a toilet paper dispenser sufficiently in the bathroom so that the patients can reach them easily while sitting.

18. Select a toilet flushing lever and a paper dispenser which can be operated with little effort.

19. Provide grab bars in the toilet and the shower area and select those which resists the patient's weight while he or she is transferring from a wheelchair or standing in the shower.

5.5. Furniture Requirements

1. Locate each room element sufficiently so that they do not get in the way of care givers.
2. Select lightweight, durable and movable furniture items.
3. Make sure that the corners of furniture are curved or rounded.
4. Consider ergonomic concerns in selection of furniture and select fire proof materials.
5. Select patient beds which are easily manipulated and adjusted by patients for eating, reading and writing, and the other activities.
6. Provide bed controls that are easily understood by the patients and operable with either hands.
7. Select comfortable patient chairs which provide extra lumbar support and the foot rest.
8. Consider using chairs which serve for various physical conditions of patients and visitors.
9. Provide removable seat covers, moisture-proof pads, and washable fabrics for the recliners and the patient chairs.
10. Provide a wardrobe which is large enough to hold a patient's personal belongings.
11. Locate adjustable clothe rods and hooks sufficiently in a wardrobe so that the ambulatory patients and the wheelchair users can reach them easily.
12. Provide a lockable drawer in the wardrobe.
13. Select opening and closing hard ware that are easily operated by the patients with hand impairments.
14. Provide a space for storage of toiletries, towels, and bath clothes in a patient bathroom.
15. Provide a wide shelf, a tackboard and the other type of means for the patients to display cards, personal items and flowers.

16. Provide an additional space for the storage of food, knik-knacks, gifts, and visitors' belongings such as clothes or bags.

17. Select overbed tables which are adjustable to various heights.

Provide movable bedside stands so that even the bedridden patients can reach the top and the drawer easily.

18. Make sure that the drawer can be easily manipulated by patients with limited dexterity.

19. Place a wall-mounted patient television and a tackboard, a patient clock, and the art works sufficiently so that the patients can view them easily while lying in the beds.

20. Avoid using a patient clock which has an institutional looking with small numerals on it.

21. Provide an art card program so that the patients can see different art works periodically.

22. Select photographs and paintings that present natural views and the objects.

23. Avoid complex textures, colors and abstract expressionist paintings, and posters with words.

5.6. Color Requirements

1. Consider the distribution of light , size and the shape of the patient rooms.
2. Consider the special needs of the patient population.
3. Consider the nature and the severity of illnesses.
4. Consider the laws of perception.
5. Consider using the colors that are flattering to the skin tones.
6. Avoid using the color white in all surfaces in the patient room.
7. Avoid to create a monotonous room environments
8. Consider using pastel colors in the bedrooms and the bathrooms.

9. Consider using light tint of rose or peach in the patient bathrooms.

10. Consider the relationship between the energy centers of the human body and the impacts of the certain colors on them.

5.7. Natural and Artificial Lighting Requirements

1. Provide unobstructed visual access to window.

2. Provide large windows and arrange convenient sill heights in order to allow even bedridden patients to see sky and ground.

3. Consider selecting window sets that have operable sliders and vents.

4. Provide the control devices of the shades of exterior windows that can be reached by both ambulatory patients and the wheelchair users. Make sure that controls can be manipulated easily by those with hand impairments.

5. Provide the roof windows and skylights with convenient diffusers.

6. Consider the heat of the direct sunlight which can be both negative or positive for the patients during the hospitalization.

7. Provide supplementary electric lighting in the fringe zones of daylit areas.

8. Provide a flexible lighting design with light dimmers and double switching of the general lighting fixtures so that the illumination can be controlled according to various activities and conditions.

9. Provide full-spectrum lighting source in the patient rooms

10. Consider using both fluorescent and incandescent lighting in the patient room.

11. Provide the general room lighting and the examination lighting that have color characteristics as close as possible to natural daylight.

12. Provide local reading and the examination lighting fixtures that are adjustable for the various activities.

13. Place the watch lighting in order to provide a sufficient nurse observation without disturbing sleeping patients.

14. Provide a night-light that gives sufficient illumination for the safe movements of patients in both bedroom and the bathroom.

15. Locate the lighting controls so that the patients and the care givers can reach them easily.

5.8. Heating, Ventilation and Air Conditioning Requirements.

1. Consider the special needs of the patient population.
2. Locate the HVAC system sufficiently so that it does not create drafty zones.
3. Select the ventilation system that is capable of providing 10 air changes per hour.
4. Provide the heating system that maintains a temperature 24 ° C.
5. Select the cooling system that provides a temperature 26 ° C.

6. CONCLUSION

The aim of this study is to point out the general criteria for creating therapeutic patient room environments. Additionally, the intention is to gauge the value of design for the health care.

In order to figure out the requirements of the therapeutic room environment the relationship between the human and the built-environment is investigated. The powerful impacts of physical settings on human physiology and psychology are explored as well. The inherent power of the built-environment on human beings is necessarily stated in order to provide a groundwork or introduction for the latter part of the study. It is also required in order to establish 'the design' as a healing tool which would be used constructively for successful patient care.

A successful acute-care patient room must satisfy the users' needs. Therefore, the most critical user group should be established. Their expectations and psychological needs related to a room design should be stated as well. In this sense, the psychological conditions of persons with physical impairments, their needs and the hospital environmental factors that put an extra stress on them are explored. In order to understand the psychological conditions of the patients, it is important to view the hospitalization process through the patients' eyes. The fact is that hospitalization is stated as the major stressor that affects all the patients regardless of the severity and the nature of their illnesses. In order to create

successful hospital rooms, necessary hospital stress factors and their potential impacts are examined. In this sense, patients' need of controlling the social contact and privacy, the sense of control over the room, patients' need of personalization of the room space and the olfactory factors are stated as the potential hospital stressors and considered as the psycho-spatial factors which must be taken into account in the design of the patient rooms. Privacy concerns are discussed within the context of visual and acoustical privacy needs which are both necessary for the patient's sense of comfort during the hospitalization. In addition, various ways for giving the patients ability of controlling visual and acoustical privacy and social contact, sense of control over the room, personalizing their own spaces in the rooms are stated. The need of odor control in the patient rooms and importance of creating odor free environments for the patients are also studied as the other hospital stress factor. It is pointed out that a lack of those requirements cause an extra stress on patients who are already stressed by hospitalization.

The main purpose of the hospitalization is examined as the second step. Since hospitals are places for restoring the patients to health, requirements of the health care delivery and their relations to a patient room design are explored. It is found out that the successful health care delivery in the patient rooms depends to various factors. The health care team's needs related to the design must be satisfied. In this manner, the necessary requirements of the size and the layout of the patient room are stated. The activities of the health care team which are performed in the room are explored. Activity patterns of the critical user groups and their relation with the room elements are stated. In addition, the requirements of the accessible patient room design which are vital for the health care givers, equipment and physically impaired patients are necessarily stated in order to

provide a successful medical treatment. Various furniture item and their placement requirements are explored as an other important factor for the successful patient room design. Light and lighting design requirements is discussed within the context of medical and nursing services needs, the patients' needs and the lighting control systems. The fact is that designing a flexible lighting system which is capable of providing various illumination levels required for different activities is necessarily required for the successful patient rooms. In this sense, requirements of providing the natural light and the artificial lighting properly and setting a control system with multiple switching and dimming are stated. Important considerations of using sufficient color palette for the patient rooms, providing the patients an adequate thermal room environments, and selecting the best materials for the rooms which are required for designing a successful patient rooms are stated.

As the final step, the design guidelines that are essential for creating therapeutic patient room environments where patients' recovery and well-being is supported psychologically as well as medically are stated. Requirements are given under eight issues which are acoustical privacy requirements, visual privacy requirements, control over the room, size and layout requirements, use of color requirements, natural and artificial lighting requirements and heating, ventilation and air conditioning requirements.

These guidelines will hopefully help the health care designers and architects in the future patient room designs and also support the patients in their hospitalization processes so that they would not feel like an other statistics in the hospital computer.

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